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Pin Method of Measuring Worms and Helical Gears

Accurate Formulas that Take into Account the Lead or Helix Angle when Determining the Required Measurement over Pins or Wires in Checking Screw Threads and Helical Gears

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PROBABLY the most convenient way to check the diameters of screw threads or helical gears is by measuring over pins or wires placed in the thread grooves or tooth spaces. This method is favored because pins or wires and micrometers are generally available, and thus it does not require expensive and special equipment.

In determining this measurement, the effect of the lead or helix angles must be taken into account (except in the case of small angles) to avoid excessive error. [The *lead angle* is a term commonly applied to screw threads and worms to indicate the angle of the helix as measured from a plane perpendicular to the axis (see diagram *A*, Fig. 2). The term *helix angle* as applied to helical gears is related to the axis and is the complement of the lead angle, equalling 90 degrees minus lead angle (see diagram *B*, Fig. 2). Lead and helix angles in these calculations are generally assumed to be based upon the pitch diameter, except in special cases as noted.]

In the practical application of the pin method of checking screw threads and helical gears, there would be an advantage in using any available size of pin or wire, provided the over-all measurement could be determined readily. If the lead angle of a worm or screw thread is so small that its effect upon the over-all measurement is negligible, then in the approximate formulas, any available pin diameter may be used within certain minimum and maximum limits. Even with these approximate formulas, however, it is preferable to use pins or wires of the so-called "best size," because they contact near the pitch line or mid-slope

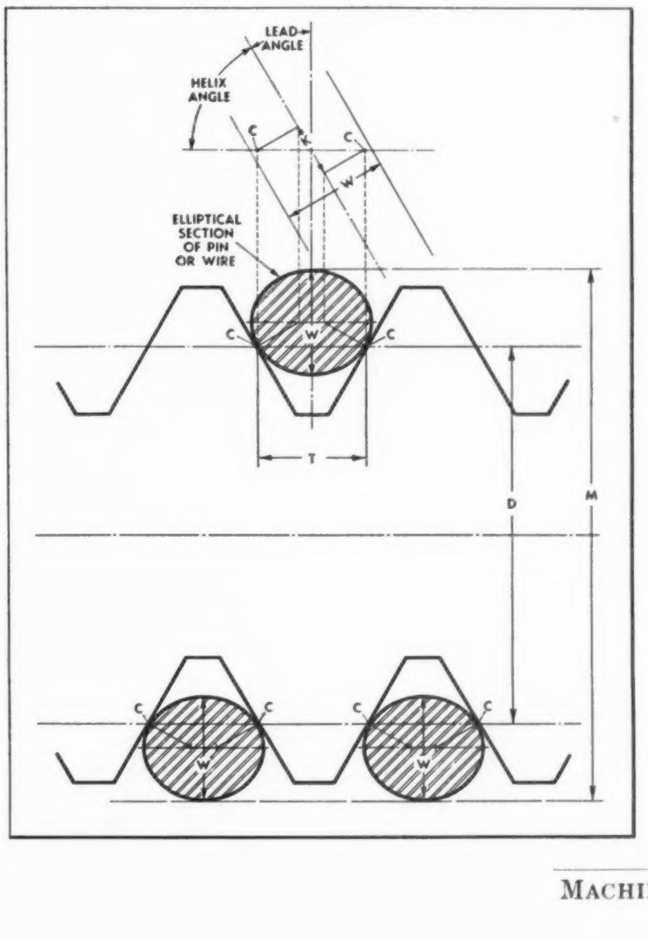


Fig. 1. Elliptical Sections of Pins or Wires Make Contact at Two Points C and C in Axial Plane; the Formula Takes into Account the Effect of Lead or Helix Angle on Dimension M

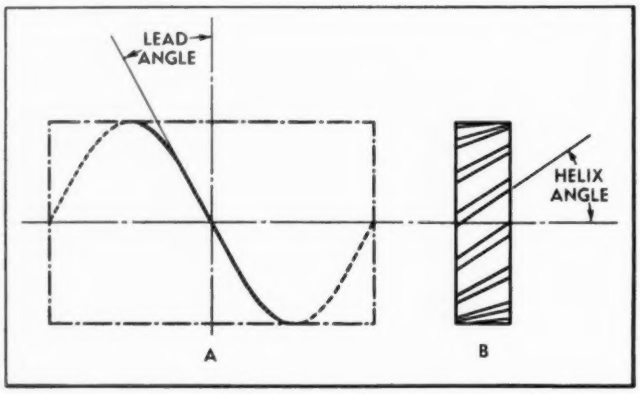


Fig. 2. (A) "Lead Angle" of a Screw Thread or Worm; (B) "Helix Angle" of a Helical Gear

of the thread, so that any error in the thread angle will not affect the thread measurement over the pin.

Whenever the lead angle is large enough to seriously affect the over-all measurement, an exact solution of the problem involves three variables, namely, the diameter of the pin; the diameter of the worm or helical gear at the points where the pin makes contact with the helicoidal surfaces; and the angle of the axis of the pin in relation to the axis of the helicoid. This angle of pin will be the helix (or lead) angle of the helicoid at the point of contact, except in the case of a short helical gear whose face width is less than the axial space width at the point of contact; in the latter case, the contact will take place at opposite edges of the face of the gear, as explained later.

General Formulas for Pin Diameter and Measurement Over Pins

In the solution of any given problem of this type, we will have as fixed or definite values, the form and lead of the helicoid and some diameter where the thread or tooth space width is a known amount. If we solve this problem, starting with a definite diameter at the points of contact between the pin and helicoid and at points where the helix (or lead) angle and space width are known, then we have but a single unknown value for which to solve—namely, the diameter of the wire or pin. But this method will require the use of pins of special size.

On the other hand, if we start with the size of the pin, then we must solve for two interrelated unknown values; this will lead to indeterminate equations which must be solved by successive trials. In some cases, however, when the lead angle is small and the thread angle is large, we may use simpler approximations which will be sufficiently accurate in this restricted range.

Notation for Formulas

We will start with an exact solution and determine the diameter of the pin and the measurement over the pins. The following symbols will be used throughout:

M = measurement over pins for given diameter D (see Fig. 1);
D = pitch diameter or any diameter where width of thread or tooth space is known;
B = lead of helicoid (lead of screw thread or of helical gear);
N = number of "starts" on screw thread or number of helical gear teeth;
P = axial pitch of helicoid or pitch of screw or worm;
P_c = circular pitch of helicoid at D in plane of rotation;
T = axial space width at $D = 0.5P$ for screw threads;
T_r = arc space width at D in plane of rotation;
L = lead angle of helicoid at D, measured from plane of rotation or plane perpendicular to axis;
A_t = one-half included angle of thread in axial plane, or axial pressure angle at D;
A = normal pressure angle at D = one-half included angle of cutter when thread is milled;
H = helix angle at D relative to axis (complement of lead angle); and
W = diameter of pins or wires.

Then

$$\operatorname{Tan} L = \frac{B}{\pi D} = \frac{NP}{\pi D} \qquad \operatorname{Tan} H = \frac{\pi D}{B}$$

Note: $L + H = 90$ degrees; $\sin L = \cos H$; $\cos L = \sin H$; $\tan L = \cot H$.

These relationships hold true whether we are dealing with a straight-sided form or the tangents to curved forms as on an involute helical gear.

General Formulas for Screw Threads or Helical Gears

In the general formula (1) which follows, the pin or wire size W is special to permit an accurate and a direct solution or one not involving indeterminate equations and successive trials. This special pin size is obtained by Formula (2). Although the advantage of using any available pin size is recognized, this is more than offset by the difficulties encountered in attempting to determine the over-all measurement in cases where the lead or helix angles are large enough to result in excessive errors if ignored.

This general formula (1), with its special wire size determined by Formula (2), not only gives an exact solution, but it can be applied, without modification, to all screw threads, including worms, and also to helical gears except cases as mentioned later (a) when the face width of the helical gear is small enough to change the normal points of contact between pins and teeth, and (b) when the pins or wires are deflected sufficiently under the measuring pressure to introduce appreciable errors.

$$M = D + W\ (1 + \sin A) \qquad (1)$$

$$W = \frac{T \cos L}{\cos A} \qquad (2)$$

Note: If N is odd, then two pins must be used on one side of the worm and a third pin on the opposite side (see diagram Fig. 1); otherwise, a correction must be made because the high points of the pins will not be diametrically opposite each other. While Formula (1) applies to either screw threads or helical gears, the spur gear represents a limiting case with line contact between the pins and teeth instead of point contact, so that the exact spur gear solution represents a different problem.

Application of Formula to Screw Threads

In the application of Formula (1) to screw threads or to worms, there are two general cases to be considered.

Case 1—The screw thread or worm is to be milled with a cutter having an included angle equal to the nominal or standard thread angle which is assumed to be the angle in the axial plane. For example, a 60-degree cutter is to be used for milling a thread. In this case, the thread angle in the plane of the axis will exceed 60 degrees by an amount increasing with the lead angle. This variation from the standard angle may be of little or no practical importance if the lead angle is small or if the mating nut (or teeth in the case of worm gearing) is formed to suit the thread as milled.

Case 2—The screw thread or worm is to be milled with a cutter reduced to whatever normal angle is equivalent to the standard thread angle in the axial plane. For example, a 29-degree Acme thread is to be milled with a cutter having some angle smaller than 29 degrees (the reduction increasing with the lead angle) to make the thread angle standard in the plane of the axis. Theoretically, the milling cutter angle should always be corrected to suit the normal angle; but if the lead angle is small, such correction may be unnecessary.

If the thread is cut in a lathe to the standard angle as measured in the axial plane, Case 2 applies in determining the pin size W and the overall measurement M.

In solving all problems under Case 1, the angle A used in Formulas (1) and (2) equals, for milled threads, one-half the included angle of the milling cutter.

When Case 2 applies, the angle A for milled threads also equals one-half the included angle of the cutter, but the latter is reduced and is determined as follows:

$$\text{Tan } A = \tan A_t \times \cos L$$

The included angle of the cutter or the normal included angle of the thread groove equals $2A$.

Examples 1 and 2 given in the following illustrate Cases 1 and 2.

The example that follows illustrates Case 1. An Acme screw thread is to be milled with a cutter having an included angle of 29 degrees; consequently, the angle of the thread is over 29 degrees in the axial section.

Example 1 (Case 1)—The pin size W and overall measurement M are required for a multiple Acme thread on a rapid-traversing lead-screw. The outside or major diameter is 2 inches; the pitch, 1/4 inch; the lead, 4 inches; the number of threads or "starts," 16; and the pitch diameter, 1.875 inches.

Then $D = 1.875$; $T = 0.125$; $B = 4$; and $A = 14.50$ degrees.

Note: The angle of the thread milling cutter has not been corrected to produce the 14.50-degree angle in the axial section.

$$\text{Tan } A = 0.25862;\ \sin A = 0.25038;\ \cos A = 0.96815$$

$$\text{Tan } L = \frac{4}{1.875 \times 3.1416} = 0.67906$$

$$L = 34.179 \text{ degrees};\ \sin L = 0.56178;\ \cos L = 0.82728$$

$$W = \frac{0.125 \times 0.82728}{0.96815} = 0.10681 \text{ inch}$$

$$M = 1.875 + 0.10681 \times (1 + 0.25038) = 2.00855 \text{ inches}$$

Example 2 (Case 2)—A triple-threaded worm has a pitch of 1 1/2 inches or a lead of 4 1/2 inches, a pitch diameter of 2.481 inches, and a lead angle of 30 degrees. The nominal included thread angle is 60 degrees; hence, the cutter angle is to be reduced to obtain this thread angle of 60 degrees in the axial plane. From the data given,

$$T = 0.75 \text{ inch};\ \cos L = 0.866025;\ \tan A_t = 0.57735$$

The tangent of the reduced cutter angle is found by the formula:

$$\text{Tan } A = \tan A_t \times \cos L$$

$$\text{Tan } A = 0.57735 \times 0.866025 = 0.49999$$

$A = 26.570$ degrees, making the included cutter angle 53.14 degrees.

$$\text{Cos } A = 0.894388;\ \sin A = 0.44729$$

$$W = \frac{0.75 \times 0.866025}{0.894388} = 0.7262 \text{ inch}$$

$$M = 2.481 + 0.7262 \times (1 + 0.44729) = 3.532 \text{ inches}$$

Application of Formula to a Helical Gear

When the problem is to determine the pin size W and measurement M for a helical gear, the arc space width T_r in the plane of rotation is used instead of the axial space width T.

$$T_r = T \tan H = \frac{T}{\tan L}$$

$$W = \frac{T_r \cos H}{\cos A} = \frac{T \sin H}{\cos A} = \frac{T \cos L}{\cos A}$$

For even numbers of teeth measuring over two pins and odd numbers of teeth measuring over three pins, Formula (1) is used for obtaining dimension M. In finding the pin diameter W, Formula (2) could be used, but it is preferable to substitute T_r for T and $\cos H$ for $\cos L$, as shown in the preceding formula (see first formula after W). Theoretically, the results would be the same in each case.

Example 3—Find measurement M for checking a helical gear having 30 teeth, 10 normal diametral pitch, 10-degree helix angle, 14 1/2-degree normal pressure angle, 3.0463 pitch diameter, 0.1595 arc width of space at pitch diameter, 54.2839 inches lead. This gives the following values:

$$D = 3.0463;\ T_r = 0.1595;\ B = 54.2839;$$
$$A = 14.50 \text{ degrees};\ H = 10 \text{ degrees.}$$

$$\tan A = 0.25862;\ \sin A = 0.25038;$$
$$\cos A = 0.96815$$

$$\tan H = 0.17633;\ \cos H = 0.98481$$

$$W = \frac{0.1595 \times 0.98481}{0.96815} = 0.16224$$

$$M = 3.0463 + 0.16224 \times (1 + 0.25038)$$
$$= 3.24916 \text{ inches}$$

For odd numbers of teeth measured with two wires, we have:

$$M = (D + W \sin A) \cos \frac{90 \text{ deg.}}{N} + W \qquad (3)$$

Contact between Pins and Gear Teeth or Screw Threads

When pins or wires are inserted in thread grooves or between helical gear teeth, there are only two points of contact. This is shown by the fact that a pin will always rock around a gear. With three or more points of contact, this rocking action would not occur. Now these points of contact C, C, with the elliptical sections of the pins, always lie in the axial plane of a screw thread or worm (see Fig. 1). They are also in the axial plane of a helical gear unless the face width is too small to permit this, in which case the two contacts will be at the opposite sides or edges, as previously mentioned. As the lead angle of a screw increases or the helix angle of a gear decreases, the distance K between the points of contact C and C will increase (up to the limit in the case of a gear set by the face width).

When Face Width of a Helical Gear is Less than Axial Space Width at a Given Diameter

When the face width of the gear is less than T, or $\frac{T_r}{\tan H}$, and the theoretical contacts between the pin and the gear tooth are at the edges of the face, an exact solution of measurement M becomes quite involved. A close approximation follows:

F = face width of helical gear (which is less than T)

$$\text{Arc } R \text{ in radians} = \frac{T_r - F \tan H}{D}$$

$$W = \frac{T_r \cos H}{\cos (A + R)} \qquad (4)$$

For even numbers of teeth:

$$M = D \cos R + W\,[1 + \sin (A + R)] \qquad (5)$$

For odd numbers of teeth:

$$M = [D \cos R + W \sin (A + R)] \cos \frac{90 \text{ deg.}}{N} + W \qquad (6)$$

Example 4—Using the values given in Example 3 and a face width F of 0.500 inch,

$$\text{Arc } R = \frac{0.1595 - (0.500 \times 0.17633)}{3.0463}$$
$$= 0.02342 \text{ radian}$$

One radian = 57.2958 degrees; hence

$$\text{Arc } R \text{ in degrees} = 57.2958 \times 0.02342 = 1.342$$

[A table for converting degrees into radians, or vice versa, will be found in "Manual of Gear Design, Section 1," page 131, published by THE INDUSTRIAL PRESS.] Then $\cos R = 0.99973$

$$(A + R) = 15.842 \text{ degrees};\ \sin (A + R)$$
$$= 0.27298;\ \cos (A + R) = 0.96202$$

Applying Formula (4),

$$W = \frac{0.1595 \times 0.98481}{0.96202} = 0.16328 \text{ inch}$$

This is a slightly larger pin than before. As the number of teeth is even, use Formula (5).

$$M = (3.0463 \times 0.99973) + 0.16328 \times$$
$$(1 + 0.27298) = 3.25333 \text{ inches}$$

Compensating for Possible Deflection of Pins or Wires

Whenever slender pins or wires are supported by widely separated points of contact (C and C, Fig. 1), so that each pin is like a beam supported at these two points, deflection may occur due to measuring pressure until contact is made directly beneath the measuring points. For example, if slender pins or wires are applied to a gear of small helix angle and fine pitch, the deflection due to the pressure of measurement may result in appreciable error; consequently, the pin diameter should be increased to compensate for this deflection as shown by the following formulas, which give a close approximation.

$$\text{Arc } Z = \frac{T_r \cos^2 H}{D}$$

$$W = \frac{D \sin Z}{\cos H \cos (A + Z)} \qquad (7)$$

For even numbers of teeth:

$$M = D \cos Z + W\,[1 + \sin (A + Z)] \qquad (8)$$

For odd numbers of teeth:

$$M = [D \cos Z + W \sin (A + Z)] \cos \frac{90^\circ}{N} + W \qquad (9)$$

Example 5—Again using Example 3,

$$\text{Cos}^2 H = 0.96985$$

$$\text{Arc } Z = \frac{0.1595 \times 0.96985}{3.0463} = 0.05078 \text{ radian}$$

$Z = 2.909$ degrees; $\sin Z = 0.05075$; $\cos Z = 0.99871$; $(A + Z) = 17.409$ degrees; $\sin(A + Z) = 0.29919$; $\cos(A + Z) = 0.95419$

$$W = \frac{3.0463 \times 0.05075}{0.98481 \times 0.95419} = 0.16452 \text{ inch}$$

This pin is slightly larger than the preceding one.

$M = (3.0463 \times 0.99871) + 0.16452 \times (1 + 0.29919) = 3.25611$ inches

Errors in Tooth Thickness Resulting from Pin Deflection

In Examples 4 and 5, the pins are slightly larger than in Example 3. Let us compare Examples 3 and 5: Taking the difference of pin diameters into account, and assuming that the form does not depart materially from the straight-line form in the small distances involved, we have the following:

Let x = difference between sizes of pins; and

y = difference between measurements.

Then

$$y = x\left[1 + \frac{1}{\sin(A + Z)}\right]$$

$$x = 0.16452 - 0.16224 = 0.00228$$

Difference between calculated measurements $M = 3.25611 - 3.24916 = 0.00695$

$$y = 0.00228\left(1 + \frac{1}{0.29919}\right) = 0.00228 \times 4.34235 = 0.00990$$

These two values, if the solutions were exact and no errors were introduced by dropping out decimal places, should be alike. As they stand, they show a difference of $0.00990 - 0.00695 = 0.00295$

When z = difference in tooth thickness in plane of rotation and y_1 = error in measured value,

$$z = \frac{y_1 \tan(A + Z)}{\cos H}$$

In this case, $y_1 = 0.00295$ and $\tan(A + Z) = 0.31355$. Hence,

$$z = \frac{0.00295 \times 0.31355}{0.98481} = 0.00094$$

In other words, the last approximation in this example results in a probable error of slightly less than 0.001 inch tooth thickness in the plane of rotation.

If the figures given in Example 3 were used and the pin deflected under the measuring pressure until contact was made between the pin and gear tooth under the point of measurement, then the measurement would be smaller than the calculated one by an amount between 0.007 and 0.010 inch. On coarser pitches, where the diameter of the pin is larger, this deflection of the pin may be less than the maximum and of an unknown amount. With a known measuring pressure, the amount of this deflection could be calculated; but the wedging of the pin into the tooth space would also need to be determined. This condition of deflection of the pins is one of the reasons why the pin measurement of helical gears often gives inconsistent results.

Relation Between a Formula for Screw Threads and the Simplified General Formula (1)

The following formula (10), (taken from Communication B-523, Gage Section, Bureau of Standards) also gives an exact solution for measurement M as applied to screw threads. The results obtained with Formula (10) when arranged to solve for M, and the comparatively simple Formula (1) will be the same, provided in each case the pin size is determined from Formula (2). After giving Formula (10), its relationship to Formula (1) will be shown.

$$D = M + \frac{P}{2}\text{cotan } A_1 - W \times [1 + \sqrt{\text{cosec}^2 A_1 + \tan^2 L \text{ cotan}^2 A_1}] \qquad (10)$$

Transposing to solve for M and substituting T for $P/2$ (thread thickness of screw threads is based on the diameter where the thread thickness and space width in the axial plane are both equal to one-half the axial pitch), we have:

$$M = D - \frac{T}{\tan A_1} + W \times [1 + \sqrt{\text{cosec}^2 A_1 + \tan^2 L \text{ cotan}^2 A_1}] \qquad (11)$$

In this equation we will substitute the value of the normal angle (A) in place of the axial angle (A_1).

$$\text{Tan } A_1 = \frac{\tan A}{\cos L} \qquad \text{Sin } A_1 = \frac{\tan A}{\sqrt{\cos^2 L + \tan^2 A}}$$

$$\text{Cos } A_1 = \frac{\cos L}{\sqrt{\cos^2 L + \tan^2 A}}$$

Thus we obtain

$$M = D - \frac{T \cos L}{\tan A} + W\left(1 + \frac{1}{\sin A}\right) \qquad (12)$$

When W is obtained by Formula (2),

$$W = \frac{T \cos L}{\cos A}, \quad T \cos L = W \cos A$$

Substituting, we obtain,

$$M = D - \frac{W \cos A}{\tan A} + W\left(1 + \frac{1}{\sin A}\right) = D + W(1 + \sin A)$$

This is the same as Formula (1).

In the example that follows, the Acme thread is to have an included angle of 29 degrees in the plane of the axis; hence the included cutter angle is reduced (Case 2). This example will be used in making certain comparisons in the applications of Formulas (1) and (11).

Example 6—An Acme screw thread 2 inches in diameter has a pitch of 1/4 inch, 4 starts, 1 inch lead, 1.875 pitch diameter. This gives the following values:

$$D = 1.875;\ T = 0.125;\ B = 1.000;\ \text{and}\ A_t = 14.50\ \text{degrees}$$

$$\text{Tan}\ A_t = 0.25862;\ \sin A_t = 0.25038;\ \cos A_t = 0.96815$$

$$\text{Tan}\ L = \frac{1.000}{1.875 \times 3.1416} = 0.16976$$

$$L = 9.635\ \text{degrees};\ \cos L = 0.98589$$

$$\text{Tan}\ A = 0.25862 \times 0.98589 = 0.25497;\ A = 14.304\ \text{degrees};\ \cos A = 0.96900$$

Applying Formula (2),

$$W = \frac{0.125 \times 0.98589}{0.96900} = 0.12718\ \text{inch}$$

Applying Formula (1),

$$M = 1.875 + 0.12718 \times (1 + 0.2470666) = 2.0336\ \text{inches}$$

The same value for M will be obtained by using Formula (11), provided the pin size W is made equal to 0.12718 inch as obtained by Formula (2).

When the "Best" Wire Size May be Used

Equations (10) and (11) are supposed to be used with the "best size" of wire. Designating this size as W_b, we have:

$$W_b = \frac{T}{\cos A_t}$$

Applied to Example 6,

$$W_b = \frac{0.125}{0.96815} = 0.12911$$

It is important to note, however, that when this "best size" wire is used in Equation (11) rather than the special size obtained by Formula (2), the effect of the lead angle on the points of contact and on dimension M will result in errors which increase with the lead angle and are excessive for the larger angles. With a lead angle of 9.635 degrees (Example 6), the error is small.

To illustrate, if the "best" pin size is used in Formula (11) without considering the points of contact or making a correction for the lead angle at these points, $M = 2.04335$ inches. Now, if we find by indeterminate equations and successive trial solutions the diameter at the points where this "best" pin size actually contacts, and then determine the corresponding values of T, L, and A, dimension M as obtained by Formula (1) will equal 2.04370 inches. When we ignored the effect of the "best" wire size on the points of contact and on the lead angle at these points in using Formula (11), we found that $M = 2.04335$ inches; hence, comparing Formulas (1) and (11), the difference in the two values of $M = 2.04370 - 2.04335 = 0.00035$ inch. With a smaller lead angle, the difference would, of course, be smaller.

Therefore, in applying Formula (11) to Acme screw threads having a single thread or start, either the "best" pin size or one close to it may be used, together with the lead angle at the pitch diameter, without introducing an appreciable error. In such cases, it may be preferable to use Formula (11) instead of Formula (1) in order to avoid a special pin size.

If the lead angle of a single Acme screw thread is less than about 4 degrees, the following approximation of Formula (11), which is obtained by expanding the expression under the radical and neglecting all terms beyond the second, may be used:

$$M = D - \frac{T}{\tan A_t} + W\left(1 + \operatorname{cosec} A_t + \frac{\tan^2 L \cos A_t}{2 \tan A_t}\right) \quad (13)$$

Example 7—An Acme screw thread has the same pitch and diameter as given in Example 6, but differs in that it has only a single thread, making the lead angle 2.43 degrees.

If the simplified Formula (13) is applied to this example, it will be found that dimension $M = 2.03686$ inches. If the complete Equation (11) is used, the same dimension M will be obtained. In other words, there will be no difference within five decimal places.

Screw Threads Having Small Lead Angles and a 60-Degree Thread Angle

For threads with very small lead angles, and also for the standard 60-degree threads, a still more simplified expression is used, in which the lead angle is ignored entirely, as follows:

$$M = D - \frac{T}{\tan A_t} + W\ (1 + \operatorname{cosec} A_t) \quad (14)$$

Using this equation in Example 7, we would have (using "best" wire size):

$$M = 1.875 - 0.48333 + 0.12911 \times (1 + 3.99393) = 2.03643\ \text{inches}$$

In this case, the error equals $2.03686 - 2.03643 = 0.00043$ inch.

For a standard 1-inch screw thread, 8 threads per inch, we have:

$$D = 0.9188;\ T = 0.0625;\ A_t = 30\ \text{degrees};\ \cos A_t = 0.86603;\ \tan A_t = 0.57735;$$

$$\operatorname{cosec} A_t = 2.000;\ \tan L = \frac{0.125}{0.9188 \times 3.1416} = 0.043305;\ \tan^2 L = 0.00188;\ L = 2.480\ \text{degrees}$$

$$W = \frac{T}{\cos A_t} = \frac{0.0625}{0.86603} = 0.07217 = \text{best size}$$

Using Formula (13), we have:

$$M = 0.9188 - \frac{0.0625}{0.57735} + 0.07217 \times \left(1 + 2.000 + \frac{0.00188 \times 0.86603}{2 \times 0.57735}\right) = 1.02816$$

Using Formula (14), we have:

$$M = 0.9188 - \frac{0.0625}{0.57735} +$$
$$0.07217\ (1 + 2.000) = 1.02806$$

In this case, the difference is 0.00010 inch, a correction that is necessary only in the case of accurate gages.

For a standard thread form, such as the American (National) standard form, the equation may be written with the specific values required, as follows:

When D_o = basic outside diameter of thread,

$$D = D_o - 0.64952P$$
$$T = 0.5P$$

whence

$$M = D_o - 1.5155\ P + 3W;\ \text{also}$$
$$M = D - 0.86603\ P + 3W$$

This first equation is the one found on page 1184 of the ninth edition of MACHINERY'S HANDBOOK. The Handbook formula contains the standard or basic major diameter. If the formula contains the basic pitch diameter, the constant is reduced from 1.5155 to 0.86603. The resulting dimension M is the same in each case and there is no practical advantage in using a formula containing the pitch diameter.

This article attempts to show that the measurement of screw threads, worms, and helical gears by the pin method is the same fundamentally. Different equations for these various applications are not necessary, although, as pointed out, some simplifications and approximations may be desirable under certain conditions. The exact solution represented by Formulas (1) and (2) applies equally to all helicoidal or screw thread forms.

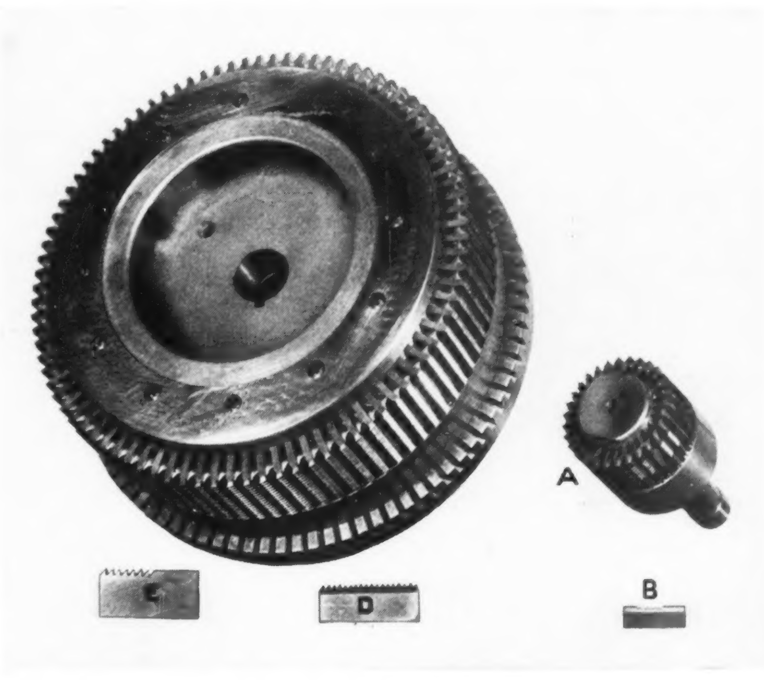
An Unusual Type of Inserted-Blade Milling Cutter

The accompanying illustration shows an inserted-tooth thread milling cutter developed by Willard E. Parish, of the Crouse-Hinds Company, Syracuse, N. Y., for use on the Hall Planetary thread milling machine. Patents have been applied for on this cutter. The construction is such that simple thin cutter blades, which can be produced complete in quantities, may be assembled in the cutter without additional grinding. The blades are clamped by means of wedges drawn radially toward the center by a conical-shaped collar at each end. The end of the blades rests against these clamping collars. When one or more blades become broken, they can be replaced individually without replacing the whole set.

To sharpen these cutter blades they are removed from the cutter and placed on a surface grinder. This method is much faster than indexing the cutter for each blade. The design permits closer spacing of the blades than in other types of inserted-blade cutters; therefore, since the metal removed is in direct proportion to the number of cutting blades engaged in the work, the production is increased. Various pitches and forms of threads can be milled, using the same cutter body and only changing the cutter blades.

In the illustration, A shows a cutter 2 7/8 inches in diameter having thirty blades, 1/32 inch thick. This cutter is used for milling a thread 3 1/8 inches in diameter, twelve threads per inch, in a cast-iron explosion-proof fitting. At B is shown a blade for this cutter.

The large cutter C is 12 1/8 inches in diameter and has ninety blades. This cutter is used for milling a 12-inch pipe thread in an aluminum casting for an explosion-proof Condulet; a blade for this cutter is shown at D. E shows a blade for a cutter 14 3/4 inches in diameter having 100 blades, used for milling a 15 3/8-inch buttress thread in cast aluminum.



Two Sizes of Inserted-blade Thread Milling Cutters Made by the Crouse-Hinds Co.

* * *

Committee to Study Rubber and Plastics

The American Society of Mechanical Engineers has established a committee on rubber and plastics which will deal with several phases of the rubber and plastics industries, including mechanical applications, research on the basic mechanical properties, processing equipment, and standards. The committee will also sponsor the presentation of papers at regular meetings of the Society. A symposium on rubber and synthetic substances with rubber-like properties, as well as on the fabrication of rubber parts, will be included in the program of the Providence meeting, October 5 to 7.

Machining Tough Roller-Bearing Material with Sintered-Carbide Tools

ONE of the problems encountered in the manufacture of roller and ball bearings is due to the fact that the S A E 52100 "bearing steel" used is very difficult to machine. This steel is a high-carbon, chromium type, and has a machineability rating of between 30 and 40 per cent, based on the accepted figure of 100 per cent for S A E 1112 steel. The recommended cutting speed for this steel is generally given at about 65 surface feet per minute. Under these conditions, machining operations on the bearing steel have been comparatively slow, and the tool life per grind on large forgings has been relatively short.

In attempting to overcome these difficulties, the Rollway Bearing Co., Syracuse, N. Y., recently made some interesting experiments with sintered-carbide cutting tools manufactured by the Firth-Sterling Steel Co., McKeesport, Pa. By means of these tests it has been definitely established that sintered-carbide tools can, when properly applied, double the production of parts made from S A E 52100 steel.

The operation consists of turning the outside diameter, back-facing, and boring a bearing sleeve having an outside diameter of 8 inches and an inside diameter of 7 inches, using a three-tool set-up.

The customary feed on a piece of this size was 0.010 inch per revolution, with the depth of cut about 5/32 inch. The length of the facing cut was 1/2 inch. On larger sleeves a feed of 0.018 inch per revolution was used. Under these conditions, the previous machining practice permitted a cutting speed of 85 feet per minute. However, 18-4-1 standard high-speed steel tools finished only three or four of the large pieces per grind, since the tools became overheated in spite of the emulsified oil cutting compounds used. Super high-speed steel of the 9 per cent cobalt type produced as high as twelve pieces per grind.

For testing purposes, a Sundstrand machine designed for sintered-carbide tools was selected, using the three-tool set-up shown in the accompanying illustration, with Type T-89 Firthite tools having 3/8- by 5/8-inch shanks. With the same feeds, depths of cut, and cutting speeds, it was possible to produce ninety pieces per grind.

A 3/4- by 1 1/4-inch tool was then used, and the cutting speed was gradually stepped up to 120 feet per minute without a reduction in the number of pieces per grind. The carbide tools now remove over 600 pounds of metal per grind. In addition, a roughing cut formerly used to remove scale from the forgings became unnecessary.

Like many other alloy steels, bearing steel work-hardens during machining and, consequently, a slight taper will develop in the piece. It has been found, however, that this difficulty is eliminated when carbide tools are used, due to the fact that the higher surface speed results in a flow type chip that greatly reduces work-hardening of the metal.

A close inspection of the finished product revealed that there is an accompanying improvement in the degree of precision obtained, which is an added advantage because of the highly precise requirements of roller and ball bearings.

Three-tool Set-up Using Sintered-carbide Tools for Machining S A E 52100 Steel

* * *

In a paper read before a meeting recently held at the Massachusetts Institute of Technology, F. L. Haushalter, development engineer for the B. F. Goodrich Co., mentioned that rubber springs have been used successfully for eliminating vibration in machines weighing up to 500,000 pounds. Not only do they prolong the life of the machines, but they also ease the strain on the nerves of the worker. "Rubber mountings, or so-called 'vibro-insulators,'" said Mr. Haushalter, "may eliminate as much as 90 per cent of the vibration in machinery. Their use also extends the longevity of concrete structures or other buildings in which the machines are housed." Mr. Haushalter also mentioned that vulcanized rubber compounds are so elastic that they can be stretched at ordinary temperatures to more than ten times their normal length before reaching the breaking point.

Fabricating Oldsmobile Rear-Axle Housings

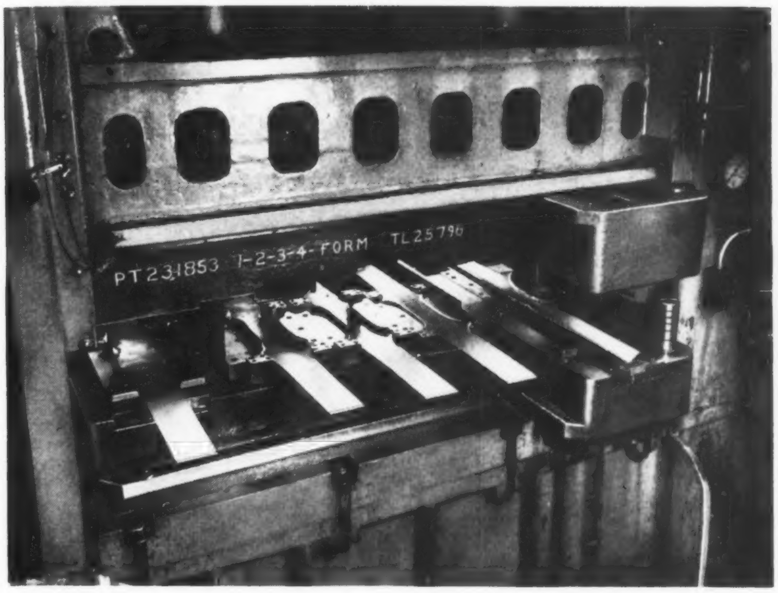


Fig. 1. Preliminary Forming Operations in the Manufacture of Rear-axle Housings at the Olds Motor Works, Using a Hydraulic Press with a Five-station Die

A Step-by-Step Description of the Methods Used by the Olds Motor Works in Fabricating Rear-Axle Housings by the Electronic Tornado Arc Welding Process

WELDING has become one of the more important of the processes used in automobile building. Every automobile manufacturer uses this cost-reducing process to a great extent. Mufflers, starter and generator frames, wire wheels, brake cross-shafts, lamp brackets, frames, chasses, bodies, and rear-axle housings owe their fast and economical present-day production to welding.

For example, engineers of the Ford Motor Co. estimate that the V-8 car would cost $3000 without the use of welding. The *Ford News* mentions that the application of welding in the River Rouge plant at Dearborn, Mich., has more than doubled every year since 1934. "The reason," says *Ford News*, "is simple. Welded construction is stronger, lighter, and infinitely cheaper. Welding has displaced 99 per cent of all bolting and riveting on the Ford car."

The present article will deal with one of the important welding processes in automobile manufacture, that of fabricating the rear-axle housing, as carried out at the Olds Motor Works plant of the General Motors Corporation at Lansing, Mich. The process employed is the so-called "electronic tornado" process of automatic shielded carbon arc welding, using equipment built by The Lincoln Electric Co., Cleveland, Ohio.

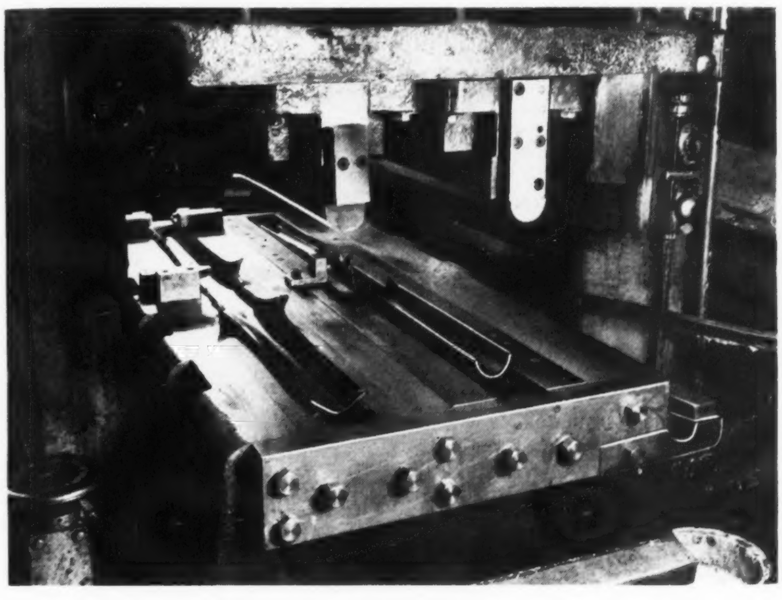


Fig. 2. Final Forming and "Restrike" Operations on Rear-axle Housings Performed in a Hydraulic Press with a Two-station Die

The forming operations are performed in a hydraulic press using a five-station die, as indicated in Fig. 1, which is operated by two men. In this press, the flat blanks are formed in five operations to a trough shape. The cycle of operations is 15 seconds; that is, the press makes a stroke and each piece is advanced one station of the die in that period. As there are always five pieces in the press, a piece is turned out every 15 seconds.

The final forming and "restrike" operations are performed in a hydraulic press using a two-station die, as indicated in Fig. 2. In the first station of this die the half-banjo is formed. In the "restrike" station the edges of the half-tube are "coined" to furnish additional thickness for the carbon arc weld. The time for this operation is 24 seconds per press stroke.

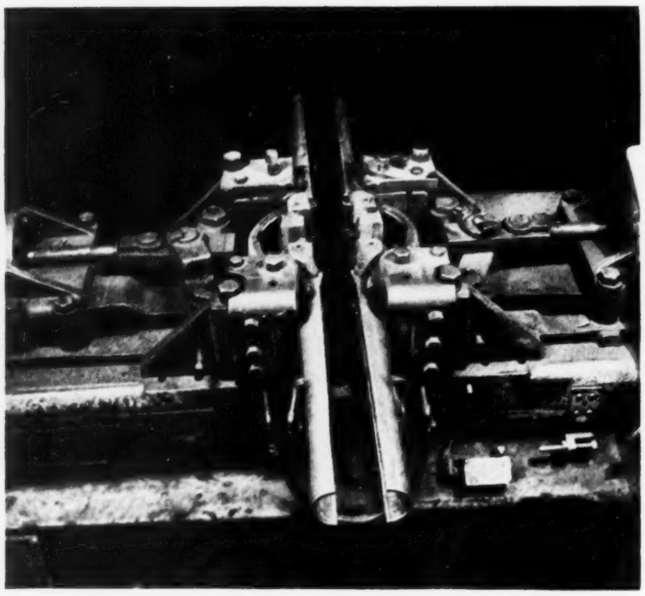


Fig. 3. A Flash Welder which Tack-welds the Two Halves of the Banjo Housing together

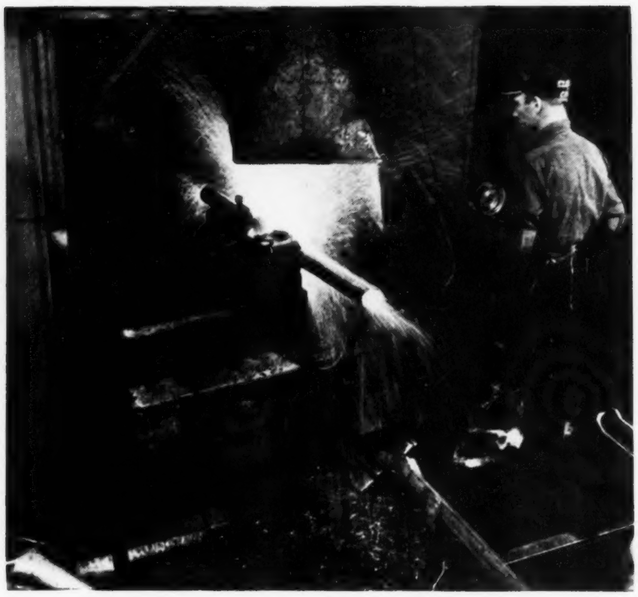


Fig. 4. Flash Welder in the Act of Tacking together the Two Halves of the Housing

A flash welder, Fig. 3, welds the two halves of the banjo at the center. This welder tacks the halves together preparatory to the automatic welding by the electronic tornado carbon arc process. The flash welder is shown in Fig. 4 in the actual operation of tacking the two halves of the banjo housing together. The time for this operation is 41 seconds.

The complete welding set-up for the production of the rear-axle housings is illustrated in Fig. 5. The flash welder is shown in operation in the left foreground, where a pile of half-banjos can also be seen. On the conveyor racks are the housings that have been flash-welded and are ready for the carbon arc welding of the long seams. The electronic tornado automatic carbon arc welders are shown at the right of the illustration, one on each side of the conveyor rack. Before welding, an autogenizing material is applied, which forms a gaseous shield about the arc, protecting the molten metal from the oxygen and hydrogen of the air and thereby preventing porosity in the weld.

Fig. 6 illustrates the electronic tornado welder ready to fuse the seam in the rear-axle housing. The two welding "boots" can be seen at the top of the illustration with the carbons projecting downward. In the welding operation, the two carbons automatically strike arcs on the flash welds at the center of the housing. After a short interval (one second or less), to allow the arcs to bring the metal to the molten state, the heads move out from the center, playing the arcs on the seam and puddling the edges together. Upon arriving at the end of the seam, the arcs are automatically extinguished and the heads returned to the center. This operation is performed on each side of the housing, the time for the complete operation being 43 seconds. One man welds 53 housings per hour, floor to floor, on two machines.

Fig. 5. The Complete Equipment for the Fabrication of Rear-axle Housings at the Olds Motor Works

The quality of welds produced with this type of welding is said to be entirely equal in physical properties to the steel being welded. The appearance of the finished seam is shown in Fig. 7. The heavy magnetic field of the automatic welder concentrates the heat of the carbon arc directly on the seam being welded and produces a puddling effect in the metal. The concentration of the arc heat is also reflected in the speed and economy of the welding.

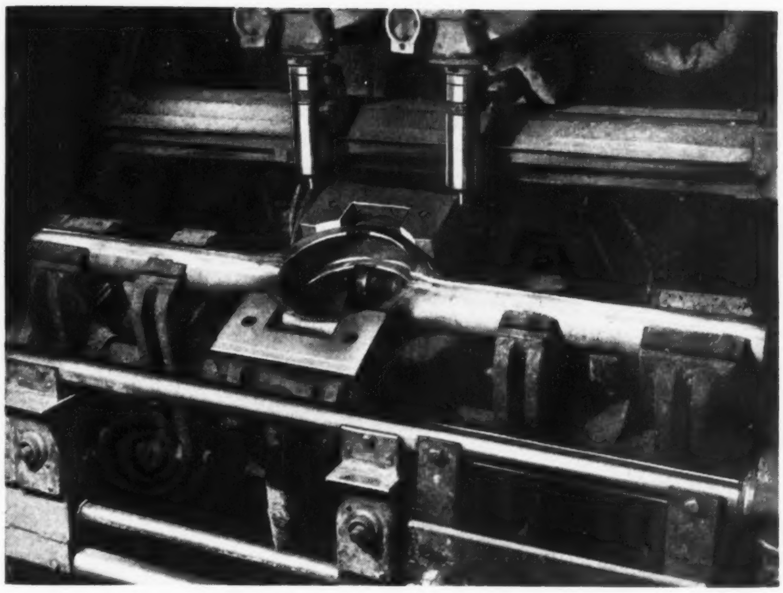


Fig. 6. The Two Halves of a Housing in a Jig, Ready to be Welded

Engineering Encyclopedia to be Placed in Crypt of Civilization

MACHINERY'S Condensed Encyclopedia of Engineering has been selected for inclusion in the Crypt of Civilization at Oglethorpe University, Ga., by the University's Advisory Board. This subterranean vault is to contain a comprehensive record of our present civilization, and the plan is to have the vault sealed for sixty centuries.

The Advisory Board is selecting from various sources records of our present civilization as contained in authoritative books of every description. To insure the preservation of the numerous books to be included in the crypt and also greatly reduce the required space, each book will be microfilmed, page by page. The microfilm has a nickel base with the image in platinum upon it. These films are to be placed in glass tubes filled with an inert gas, which will be sealed in asbestos and in stainless steel containers. The crypt will include encyclopedias, histories, scientific and religious works, motion pictures, phonograph records, photographs, models, samples of thousands of products, from chewing gum to canned peaches, and, in fact, everything likely to throw some light upon life as we know it today.

When all this work has been accomplished and the final deposit has been made in the crypt, a stainless steel door will be sealed up in the hope that it will remain inviolate until the year 8113 A. D. The year 4241 B. C., when the Egyptian calendar was established, is said to be the earliest fixed date in history; consequently, Dr. Thornwell Jacobs, president of Oglethorpe University, in 1936 set 8113 A. D., or a period of time equally distant in the future, as the opening date for the crypt.

The inscription on the stainless steel door explains briefly the character of the contents and the purpose of preserving the records enclosed. As a safeguard against opening the crypt prior to the date prescribed, there is an appeal to the sportsmanship of future generations. No jewels or precious stones are included and the inscription mentions this fact. Precautions have also been taken against fire, earthquake, and floods.

If the English language is dead at the time set for opening the crypt, those who enter will find a key for unlocking this dead language. Behind the door, there is to be a projection machine of stainless steel with gold-plated ball bearings lubricated by graphite. Pictures on the side give directions for operating the machine with a crank. When this crank is turned, the picture of a man holding an apple will be projected upon a screen. The man will pronounce the word "apple" and it will be spelled on the screen. In a similar manner, this machine will project 3000 words which were considered sufficient to serve as a key to the understanding of all of the records in the crypt, even though nothing whatever is known about the English language.

* * *

Germany's exports of textile machinery in 1937 reached a value of over $45,500,000, as compared with $41,400,000 in 1936. Of this, $1,764,000 worth was exported to the United States.

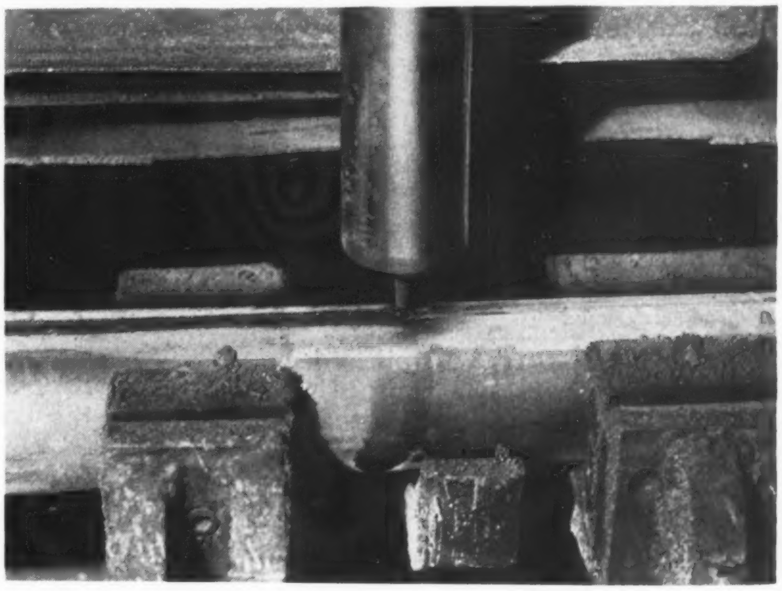


Fig. 7. Close-up View of a Partly Completed Weld on the Rear-axle Housing

Gear Shaper Designed for Progressive Cam Cutting Operations

Description of an Automatic Work-Elevating Mechanism Applied to a Gear Shaper to Enable Six Cams to be Cut on a Shaft with One Loading of the Work

By DOUGLAS T. HAMILTON
Fellows Gear Shaper Co., Springfield, Vt.

GENERATING a cam on the Fellows gear shaper is a comparatively simple operation, accomplished by using a cutter conjugate in shape to the cam. The cutting of six individual cams on the camshaft of a fuel-injection pump for the Diesel engines manufactured by the Diesel Equipment Corporation, Chicago, Ill., however, presented a far more difficult problem. This problem was solved by equipping the high-speed gear shaper shown in the various illustrations with an automatic work elevating and lowering mechanism.

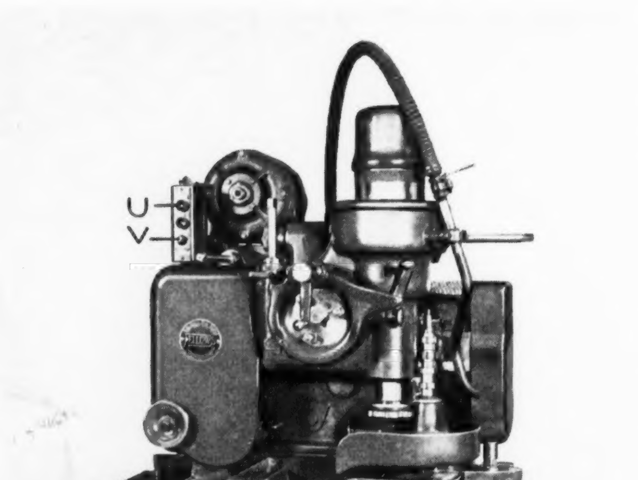


Fig. 1. Fellows High-speed Gear Shaper Equipped for Generating in One Operation All the Cams on Diesel-engine Fuel-injection Pump Camshafts

It will be seen from Fig. 2 that the six cams are spaced 60 degrees apart, but not in consecutive order, Nos. 5 and 6, for example, being 120 degrees apart. However, the cams must be cut in consecutive order, and as they are spaced in different angular positions, the cutter must be made with cutting lobes spaced to agree with the location of the cams on the shaft. The cutter lobes, therefore, are not equally spaced.

In operation, cam No. 6 is cut first, with the camshaft in the lowest position, after which the camshaft is elevated automatically into successive positions for cutting the remainder of the cams. When cam No. 1 has been finished, the machine stops automatically for removing the finished camshaft and loading an uncut camshaft. The work-holding fixture is next lowered to its bottom position, and the sequence of operations repeated.

Setting the Cutter with Relation to Work

The various cams must be cut in a definite relation to a keyway on the camshaft, as will be apparent from Fig. 2; it will also be noted that the cutter is located on its spindle by means of a key. In setting up the work for progressive cam cutting, the first step is to locate the cutter-spindle for machining cam No. 6. This is accomplished, as shown in Fig. 4, by using a special gage *A* which is provided with a keyway similar to that in the cutter. This gage is clamped on the cutter-spindle, and the spindle of indicator *B* is then brought into contact with the flat surface *C* of the gage.

Clutch *D* is next disengaged and the upper worm-shaft rotated by turning crank-handle *E* until the flat surface of the gage is positioned parallel with the travel of the saddle. In order to move the saddle back and forth for checking the parallelism of surface *C*, worm-shaft *F* is disengaged from the depth feed-gear *G*, so that the saddle can be moved by turning crank *H*. When the indicator needle registers zero at both ends of flat surface *C*, this surface is parallel with the travel of the saddle.

The work-holding fixture is next set in relation to gage *A*, as shown in Fig. 5, by means of a tap-

ered plug gage. This gage has a key similar to that on the work and fits a tapered hole in the work-holder. The plug gage is also provided with a tapered slot for engagement with a mating projection on the cutter setting gage *A*. The lower worm-shaft *J* is turned by means of a crank-handle *I* until the slot in the plug gage lines up with the projection on the cutter setting gage, a feeler gage being used to obtain an accurate setting.

The work is held in the machine by using an adapter in the work-spindle which fits the lower end of the camshaft. In addition, the camshaft is supported above the cutter by a bushing, as seen in Fig. 3. The work is clamped in the holder by means of a nut fastened to handwheel *K*, Fig. 6. Attached to the bottom of the work-holder there is a circular rack *J* with which a pinion is meshed for elevating and lowering the work. The work can be raised and lowered manually by applying a crank-handle to shaft *L* in Fig. 6 (designated *W* in Fig. 1), although in the normal operation of the machine, raising and lowering are accomplished automatically.

The Automatic Elevating Mechanism

The pinion that meshes with rack *J*, Fig. 6, is mounted on shaft *M*, Fig. 7, which extends through the machine and is connected by a worm, worm-wheel, and gears *N* and *O* to the elevating motor *P*, as illustrated diagrammatically in Fig. 9. The extended motor-shaft is equipped with a magnetically operated brake *R*, Fig. 7, to prevent coasting.

In starting the machine, the work-holder is lowered manually by applying a crank-handle to shaft *W*, Fig. 1, in order to position the work for cutting cam No. 6. Cam D_1, Fig. 7, which is geared to the elevating motor, is then set with its roller in the cam depression. When the machine is operating automatically, this cam stops the elevating motor as the work reaches the proper position for cutting cam No. 6.

Cams A_1 and E_1 are also geared to the elevating motor and make one revolution for each successive elevation of the work. They serve to stop the elevating motor with the work in position for cutting the individual cams.

An indexing cam *S* and stop-cam *T*, Figs. 8 and 9, are driven through gearing from the upper worm-shaft which rotates the cutter. Both of these cams make one revolution for each complete cutter revolution. When the locking plunger enters the slot in cam *T*, switch C_1, Fig. 9, is closed. Indexing cam *S* is set with respect to stop-cam *T*, so that the plunger enters slot No. 6 of the indexing cam at the same time that it enters the slot in the stop-cam. Slot No. 6 in the indexing cam is shallower than the other five slots, so that when the plunger enters this slot, neither switch B_1 nor B_2 is closed.

Automatic Operation of the Machine

Camshafts are unloaded and loaded with the work-holder in its upper position. After loading,

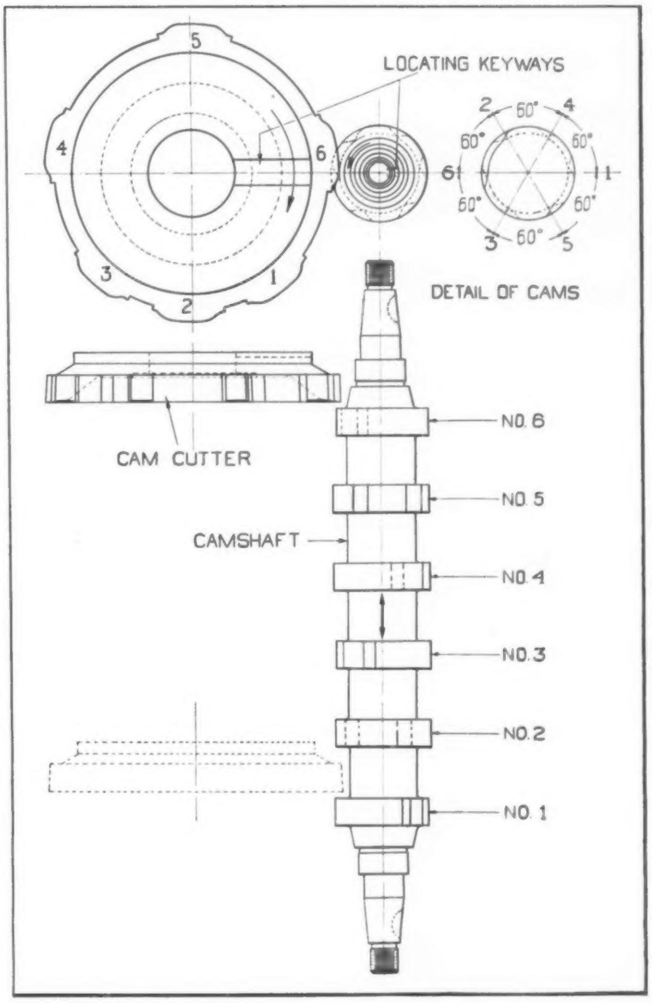


Fig. 2. Diagram Showing the Lay-out of the Six Cams Cut on One Camshaft in a Single Operation Performed on a Gear Shaper. The Lay-out of the Cam Cutter is Also Shown

the operator presses start-button *U*, Fig. 1. The elevating motor then lowers the work automatically into position for cutting cam No. 6, after which cam D_1, Fig. 9, operates to stop the elevating motor, apply the brake, and start the motor that reciprocates the cutter. When indexing cam *S* has rotated far enough to allow the plunger to enter slot No. 5, an electrical connection is made at B_1, and with the cutter still reciprocating, the elevating motor then raises the work until cam A_1 operates to stop the elevating motor and apply the brake. This cycle is repeated until all the cams are machined. Upon the completion of cam No. 1, the plunger enters the slot in stop-cam *T* to stop the machine.

The electrical equipment is so arranged that if the elevation of the work from one position to the next is not completed by the time switch B_1 is opened by the action of the plunger in withdrawing from a slot in cam *S*, the machine will stop automatically.

The same machine can also be used for cutting a camshaft having four cams instead of six. In that case, the machine is supplied with an indexing

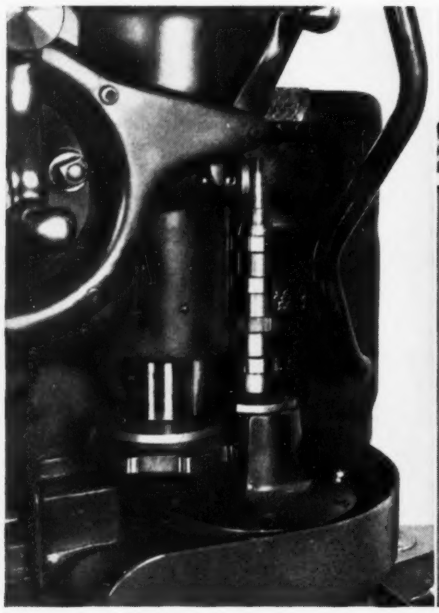


Fig. 3. Work-holding Fixture and Cutter Used in Progressive Cam Cutting

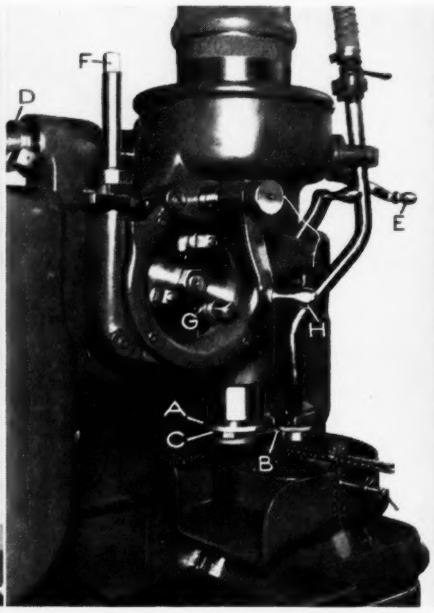


Fig. 4. Gage Used for Positioning Cutter in Relation to Work-holding Fixture

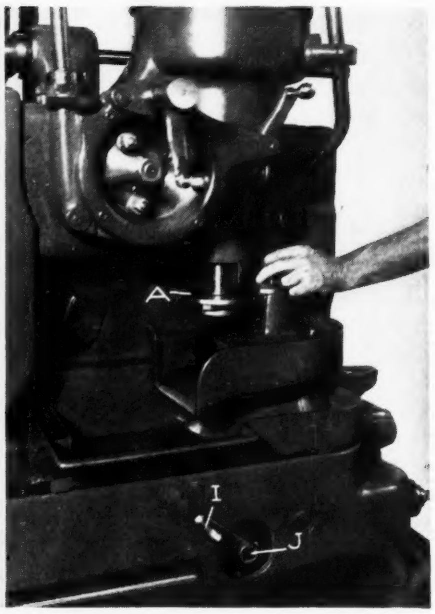


Fig. 5. Another Step in Aligning the Cutter-spindle and the Work-holder

cam having four slots and a cutter with four lobes. Cam D_1 must also be adjusted.

The use of a gear shaper has greatly reduced the time required for machining Diesel engine camshafts. These six-cam shafts were formerly finished on a milling machine with a form ground cutter at the rate of one camshaft every 23 minutes. The same camshaft is now completed on the gear shaper in a cutting time of 3 1/2 minutes and a total floor-to-floor time of 4.8 minutes. One hundred pieces are finished in eight hours.

This gear shaper can also be used for cutting gears by simply turning the selector switch button V, Fig. 1, to the "gear" position, which automatically disconnects the electrical equipment. Then only stop-cam T is effective. The machine must also be provided with a depth feed-cam and a pin must be removed from the feed ratchet to permit rotation of the feed camshaft. Small suction valves are cut on this machine at the rate of 500 pieces in eight hours, an operation that was formerly performed on a milling machine at the rate of 100 pieces in the same time.

* * *

File and Rasp Industry in 1937

According to statistics published by the Bureau of the Census, Washington, D. C., there were twenty-one plants manufacturing files and rasps in the United States in 1937. These plants employed 3715 wage earners, to whom $4,815,500 was paid in wages. The total value of the products of the file and rasp industry in the United States was $13,652,500.

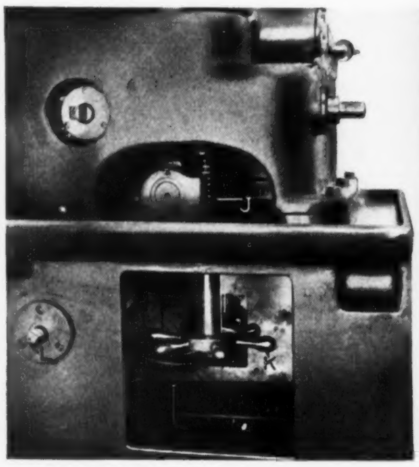


Fig. 6. The Work-clamping Handwheel and the Circular Work-elevating Rack

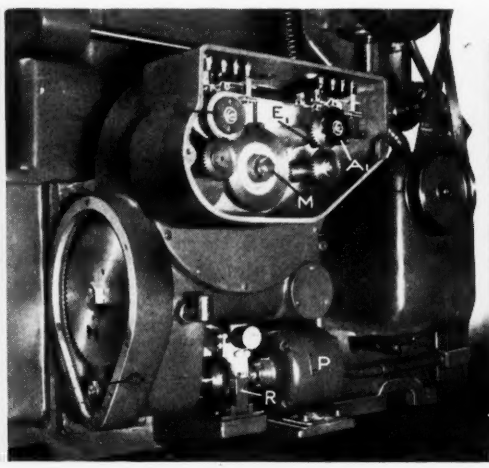


Fig. 7. Detail View of the Automatic Work-elevating Mechanism and its Motor

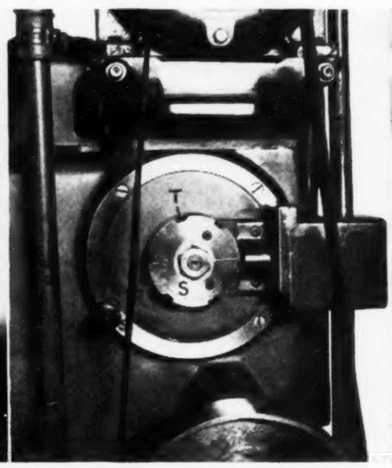


Fig. 8. Arrangement of the Automatic Indexing Cam and Stopping Cam

Increasing Use of Air-Conditioning in Manufacturing Plants

More and more manufacturing plants are being air-conditioned. One of the latest installations is in the plant of the Warren Telechron Co., Ashland, Mass., manufacturer of small clock motors. Dust removal, humidity control, and adequate ventilation were the prime factors considered in the design of the air-conditioning system installed, which is of the General Electric type. It has been applied to the assembly section of the plant by the Lawton Engineering Corporation, Boston, Mass.

If dust, dirt, or other foreign matter is not kept away from the interior of the sealed-in motors of the instruments manufactured, wear and motor failure may result. By the installation of a satisfactory air-conditioning system, the assembly room, 75 feet long and 40 feet wide, with an average head-room of 20 feet, becomes practically dust-free. The total volume of the room is approximately 60,000 cubic feet. There is a complete change of air every forty minutes. A mean relative humidity of 50 per cent is maintained. The cooling is accomplished by refrigerant at 46 degrees F. For humidification and air-washing, city water is run through the condensing unit, the condenser water temperature being 60 degrees. A dry type air filter is used to remove microscopic dust and dirt.

A slightly higher atmospheric pressure is maintained in the motor assembly room than elsewhere in the factory, so that when the doors are opened to bring in material, an influx of dust and dirt is prevented. The room temperature is held at the proper level by thermostatic control.

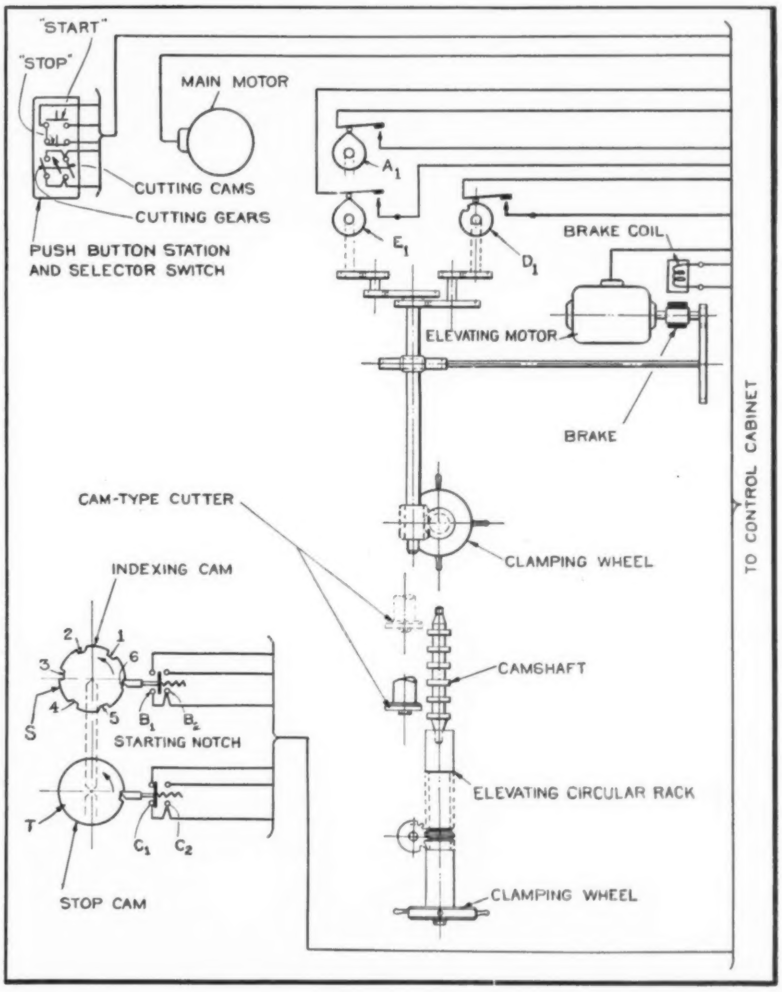


Fig. 9. Diagram Illustrating the Arrangement of the Gear Shaper Work-elevating Mechanism and its Motor Drive

* * *

The Machinery Industry and Trade of Poland

According to *World Machinery News*, published by the Machinery Division of the Department of Commerce, there are some 275 machinery manufacturing plants in Poland employing, in round numbers, 43,000 workers. The working week averages approximately 45 hours. The machinery industry in Poland is well employed, but is not able to supply the country's needs. Hence a great deal of machinery of all kinds has to be imported.

The industrial machinery imports in 1937 were valued at $14,200,000, an increase of nearly 50 per cent over 1936. The larger part of the machinery imports came from Germany and were used for newly established factories built in what is known as the "Central Industrial District." The development of this district is part of the Polish four-year plan to build up a group of industries necessary for national defense. This center is well removed from the borders.

Imports of industrial machinery from the United States during 1937 were valued at $1,550,000. While this is a small part of the total imports, it represents an increase of more than double the amount imported during 1936. The four principal suppliers of machinery to Poland are Germany, England, the United States, and Sweden, their importance being in the order mentioned.

* * *

Germany's exports of internal combustion engines during 1937 were valued at approximately $28,000,000, an increase of 56 per cent over the exports in 1936. This covers only individual internal combustion engines, and does not include engines built into vehicles or used in connection with other machinery. European, South American, and Asiatic countries furnished the most important markets.

Engineering News Flashes

The World Over

A Windowless Manufacturing Plant in New England

In 1931 the Simonds Saw & Steel Co. built a windowless plant at Fitchburg, Mass., for the manufacture of the company's products—saws for cutting wood and metal, machine knives, files, and hacksaw blades. Owing to the business depression, however, the plant was not equipped or placed in operation at that time. It has now been decided to proceed to move into the new plant, which is said to be the largest and most modern saw and knife plant in the world. The products now made at the main Fitchburg saw and knife plant, the Fitchburg file and hacksaw plant, and the Chicago band saw and cross-cut saw plant will be manufactured in the new building. The complete moving and installation of machinery will require from eight to twelve months.

The original idea of building this windowless factory was to provide working conditions for factory employes that would equal those of any executive office. By providing artificial light of daylight quality, uniformity of lighting is assured at all times of the year and at all hours. The plant will be illuminated with special lights which were originally developed for this plant and which will give a uniform light intensity of 20 foot-candles on the working plane. The temperature of the plant will be controlled to prevent appreciable variations. Everything possible has been done to eliminate noise.

The plant covers almost five acres, all on one floor without any partitions whatever. It is completely air-conditioned with a system which allows for changing over 500,000 cubic feet of air every ten minutes.

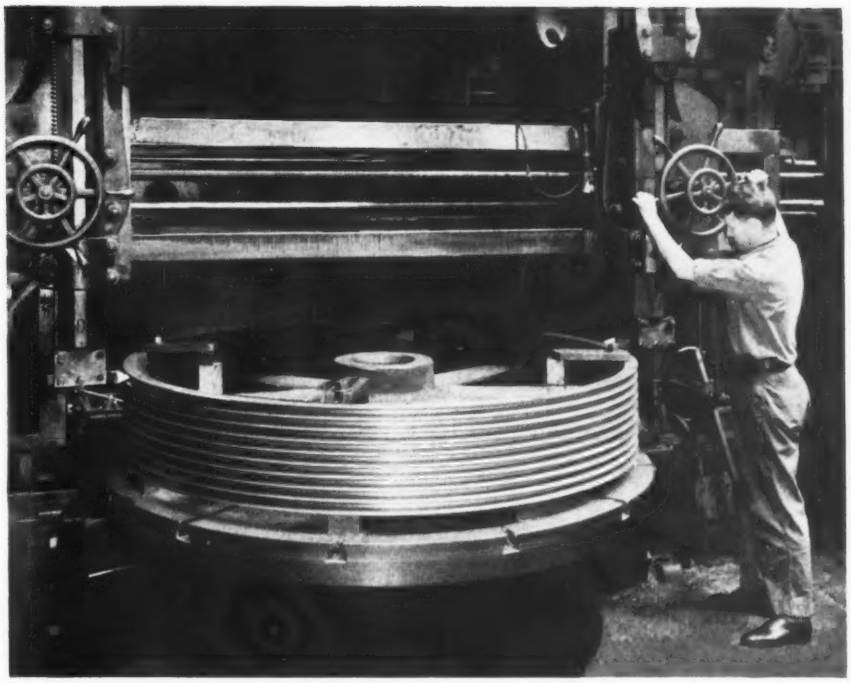
New Type of Electrical Transformer

A wound-core distribution transformer which embodies a design principle completely revolutionary in transformer construction, has been developed by the General Electric Co. As the name "wound core" implies, the important new feature of the transformer is its core construction of two continuous strips of relatively low silicon content cold-rolled steel, tightly wound into two metal rings through and around the coils. The coils are oval in shape and of short axial length.

The significance of this new wound-core transformer can be best appreciated by considering that it completely eliminates the cutting and placing of the hundreds of separate pieces of steel that make up the core of the conventional transformer. The two ribbon-like steel strips that comprise the core of the new transformer are pre-wound and assembled on machines at high speed. The wound-core transformer is appreciably lighter than a transformer with the usual core arrangement, due to the more efficient use of materials.

Examining the Surface of a Thrust Bearing for One of Two Giant Generators Built for the Pickwick Landing Dam at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. These are the Largest Thrust Bearings of Their Type in the World. They are 105 Inches in Diameter and Carry a Load of About 2,500,000 Pounds

Machining One of Three 79-inch Pitch Diameter Cast-iron V-belt Sheaves at the Allis-Chalmers Mfg. Co.'s Plant, Milwaukee, Wis. Each Sheave will be the Driven Member of a 100-horsepower Beater Drive Used in a Wisconsin Paper Mill. The Approximate Weight of Each Sheave is 3700 Pounds



Synthetic Wool—One of the Latest Accomplishments of Industry

According to *Industrial Britain*, the firm of Burgess, Ledward & Co., Ltd., of Walkden, England, has developed an artificial woollen fabric that has the characteristics of a fine natural woollen material and that also is claimed to be crease-resisting. The new cloth, known as "Jerseylaine," is a step forward in the production of synthetic products in which the scientist, chemist, and engineer have cooperated.

Long Life of Chain Drive

In 1920 the American Wringer Co., Inc., Woonsocket, R. I., installed a 400-horsepower Morse silent chain with 3-inch pitch, 12 inches wide, to transmit power from a steam engine to a lineshaft. For eighteen years this drive has operated almost continuously in twenty-four-hour duty. In all these years there has not been a single repair necessary to the chain drive. Incidentally, the sprockets on which this chain operates have been in continuous service for twenty-six years. Recent inspection showed that these sprockets are in excellent condition. The chain itself, however, should now be repinned—which would put it back in a condition as good as new. In other words, there are still many years of life left in this chain drive.

New Method of Coloring and Dustproofing Concrete Floors

Many concrete floor treatments have been available in the past. A new treatment has been developed by the Truscon Laboratories, Milwaukee Junction Post Office, Detroit, Mich., under the trade name "Flor-Dye." This new concrete floor covering does not wear off easily, peel, chip, or crack. It must be used, however, over an unpainted surface. If the concrete is painted, the old paint must first be completely removed, since the advantage of the new material is that it does not form a mere surface film, but penetrates into the concrete, becoming an integral part of the concrete floor surface. It seals the pores, preventing the absorption of any staining materials such as oils and greases. It is easily cleaned, and acts as a paint to color the surface, as well as to seal it and make it non-dusting.

London to Paris in Less Than an Hour

A new record by passenger airplane was recently established on the London-Paris route when this distance was covered in fifty-seven minutes by a plane constructed by Marcel Bloch of Courbevoie, Seine, France.

The Automobile Industry of Great Britain

The total output of automotive vehicles of all kinds in the United Kingdom rose from 73,000 in 1922 to over 500,000 in 1937. The average life of a passenger automobile in Great Britain is 7.6 years. On this basis it is estimated that the number of cars required for replacement purposes is about 165,000 annually at the present time. This figure will rise to 210,000 in 1941 with the present ratio of increase. There is still only one automobile to every nineteen people in Great Britain, as compared with approximately one to every five in the United States.

EDITORIAL COMMENT

What present excessive taxation means to employment is well exemplified by the experience of the Koppers Co. of Pittsburgh, Pa. That company, in 1937, paid in taxes the equivalent of the full-time, all-year-around average pay of 1228 employes. Some taxes are necessary, we know; Government cannot exist without income. But when two or three times the amounts formerly required are needed to run the Government—Federal, State, and Municipal—then something is decidedly wrong. There is either lack of business ability on the part of those in public office or wilful extravagance.

How the Government Curtails Employment by Excessive Taxes

Assuming that only one-half of the present taxes were necessary to run the Government if there were no extravagance and waste, then a concern like the Koppers Co. would have been able to employ over 600 additional people by simply using money now taken by the Government in taxes.

Or, to put it another way, the tax paid by the company per employe was equivalent to six weeks' pay for each worker. Say that half of this, or three weeks' pay, could have been saved through an economically conducted Government. With that amount of money saved, substantial wage increases would have been possible without affecting the earnings of the company.

Or, to put it still another way: According to the figures published by the Koppers Co., the taxes collected by the Government were \$175 for every \$100 paid in dividends to the stockholders. Those who have invested and risked their money to build the plants and factories that make possible the employment of 10,000 workers, received for their contribution \$1 to every \$1.75 paid to the Government.

Industrial Enterprise Is the Real Creator of Employment

And what does industry receive in return from Government for this tax burden? The industrial history of the last two or three years gives the answer—encouragement of industrial strife, tacit approval of and non-interference with sit-down strikes, failure to uphold the law, unfair and one-sided legislation, and attempts to silence criticism by curtailing free speech and a free press are part of that answer.

The experience of the Koppers Co. is not unique. The Eastern Gas & Fuel Associates was even harder hit by taxation. That corporation paid \$1 in tax for every \$6 paid in wages. Its total tax bill would have been sufficient to pay over 3000 employes the average annual wage for the entire twelve months; or, to put it another way, the equivalent of two months' pay for every employe was taken by the Government in taxes.

Note further that the major share of these tax payments was not based on any earnings or profits of the companies involved; in other words, irrespective of whether the companies had made any profits or not, most of these taxes would have had to be paid. Neither of the companies was subject to Excess or Undistributed Profits taxes.

If the money collected in taxes were used for the best interest of the people of the country—if it were used largely in a constructive manner, with the purpose of building up rather than tearing down—there would be some excuse for high taxes; but it is felt by all those who have given the subject careful and impartial thought that irreparable harm has been done to the national well-being of the United States and to the self-respect of a people known in the past for its self-reliance.

Wages as Well as Employment Suffer by High Taxes

Manufacturers would perform a service to their employes if they would call their attention to facts like those quoted here, showing how present excessive taxation hurts the worker just as surely as it hurts industry.

Labor, as well as industry, must ever be on the alert to guard against the fettering of freedom, even when a kindly bondage is offered by friendly hands and under the illusion of immediate relief. It is this freedom that is the distinguishing characteristic of the individualism of America. It ranks in importance with freedom of speech, freedom of the press, freedom to peaceably assemble, and freedom of conscience. It has to do with food, clothing, and shelter for all of us—those prime economic necessities without which no refinement, no culture, no civilization, however conceived or highly wrought, can exist.—*Matthew Woll, Vice-President, American Federation of Labor*

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Positive Type Reversing Clutch

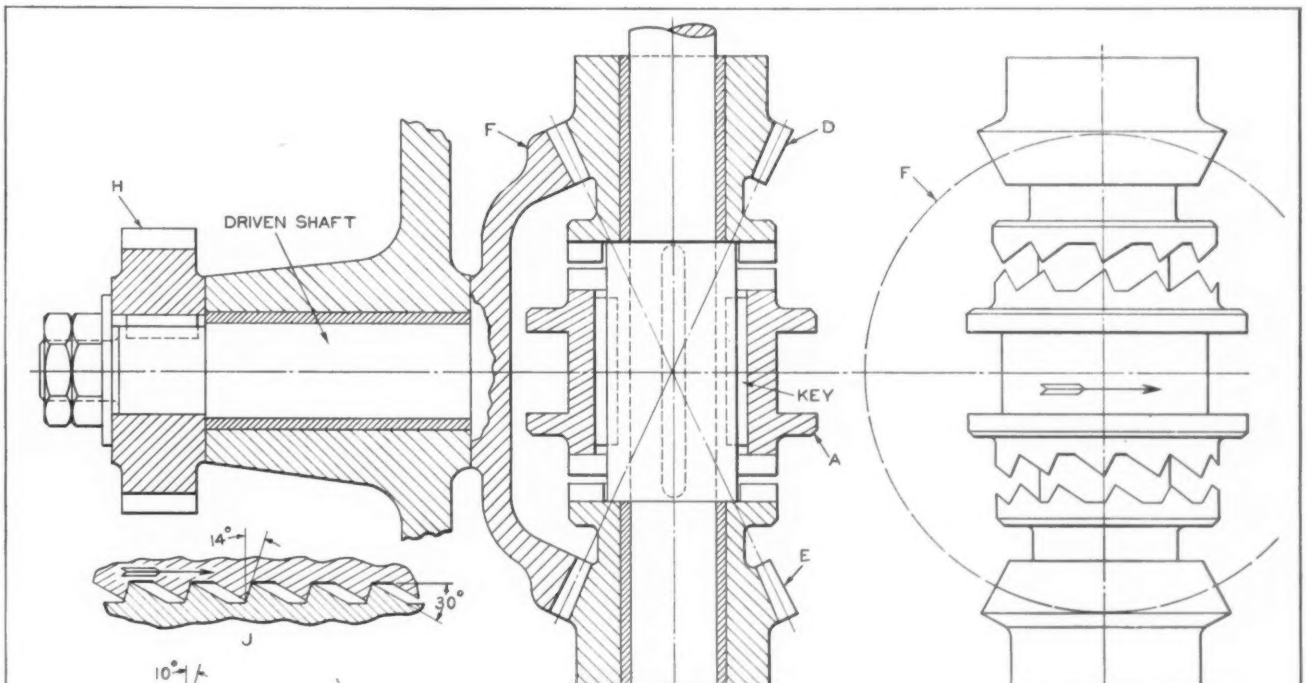
By J. R. WHITTLES

To design a positive type clutch that will release instantly under a heavy load without causing too much strain on the clutch fork or operating levers, usually necessitates considerable experimenting in order to determine the correct angle for the driving side of the teeth. When the proper angle is employed, the teeth will retain a sufficient grip to perform their work without releasing under the pressure of the load, yet the operator will be able to release the clutch with little effort.

The working conditions change, of course, with the method of operation, especially when the clutch is employed to control the movements of a slide weighing 2000 pounds. For example, the operating conditions are somewhat different when the slide is advanced by a series of short quick movements from when the slide is advanced smoothly and continuously at a uniform rate. Whether the movement is controlled by hand or by power feed, and whether or not oil or grease is employed to lubricate the ways on which the slide travels, are also factors to be considered. If the slide is fitted with a gib which must be kept fairly tight to prevent side play, as in the case of a wheel-slide on a surface grinder, this requirement must also be considered. Under these operating conditions, it is necessary that all the teeth make good contact so that the load will be distributed evenly, and thus permit the clutch to release instantly when reversing the direction of the slide movement either automatically or by hand.

The reversing clutch shown in the illustration was first made with teeth cut straight without any releasing angle. With this type of teeth, it was found impossible to reverse the clutch when the slide was in motion and carrying a full load. It was, therefore, necessary to grind the cut teeth to an angle on the driving side. This was done by setting up an indexing head to hold the clutch on the table of a surface grinder and traversing the table back and forth by hand.

After several trials, an angle of 14 degrees, as indicated by view *J*, was decided upon as the most satisfactory for the contact faces of the clutch teeth



Reversing Mechanism with Positive Clutch

for moving a wheel-slide weighing 2000 pounds. For a slide weighing 1000 pounds with exactly the same operating conditions, an angle of 10 degrees, as at *K*, was found to be most satisfactory.

Various oils and greases were tried as lubricants for the wheel-slide, with the result that grease under pressure was found to give the slide the best working conditions. Oil, even in the heavy grades, would squeeze out on the sides of the ways due to the weight of the slide, which would then stick or freeze so badly that it was almost impossible to start the slide after it had remained idle for a short time. The grease, however, was found to stick to the ways, giving them a film that made it possible to move the slide easily.

It was found advantageous to have an odd number of teeth in the clutch face to facilitate milling the teeth. A clutch with an odd number of teeth will permit an over-running milling cutter to enter a tooth space on the opposite side of the clutch, instead of cutting into a tooth.

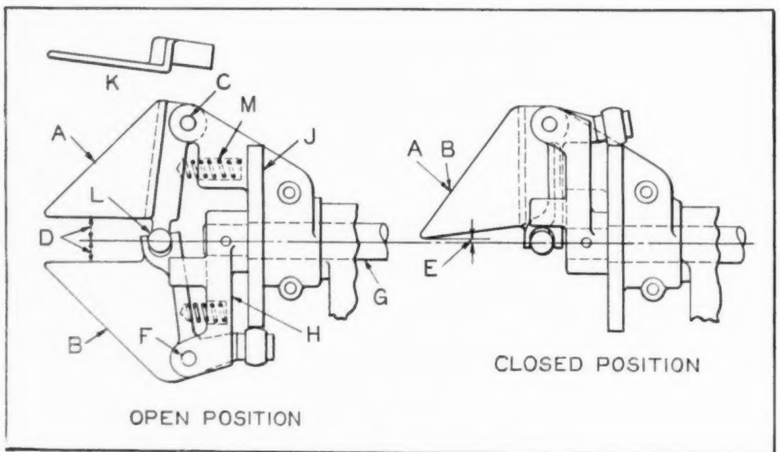
The clutch member *A*, which does the driving, has right-hand teeth cut in it at one end and left-hand teeth at the other end. The pinion bevel gears *E* and *D* have clutch teeth to match those cut on the clutch member *A*. The large bevel gear *F* meshes with the teeth in pinions *E* and *D*. A spur gear *H* meshes with a rack that moves the wheel-slide in or out.

Rotating Mechanism for Creasing Flexible Material

By FRANK HARTLEY

The mechanism shown in the accompanying illustration is designed to actuate the jaws *A* and *B* for creasing a certain flexible material. The jaws and their actuating mechanism comprise only the creasing unit of a complete machine. In operation, jaw *A* simply pivots or swings on pin *C* from the position shown in the view at the left to that shown at the right, so that the distance indicated at *D* is reduced to that indicated at *E*. While this pivoting movement is taking place, jaw *B* is pivoted inward on pin *F* a similar amount, and in addition, is rotated approximately one-half revolution. As a result of these two movements, jaw *B* is brought into position beside jaw *A*, as shown in the view to the right, in which the outlines of jaws *A* and *B* coincide.

The jaws are actuated as described by the shaft *G*, pinned to arm *H*. As shaft *G* rotates, the follower roll on an arm projecting from jaw *B* rides up on the lobe of the face cam *J*, causing the jaw to pivot or swing inward. A fork on jaw *B*, which fits over a ball *L* machined on jaw *A*, transmits the required pivoting motion to the latter jaw. Helical springs *M* maintain a constant opening pressure on the jaws. The jaws are offset, as indicated by view *K*, to permit them to be closed, as indicated in the view to the right.



Mechanism for Creasing Flexible Material

Mechanism for Converting Rotary into Reciprocating Motion

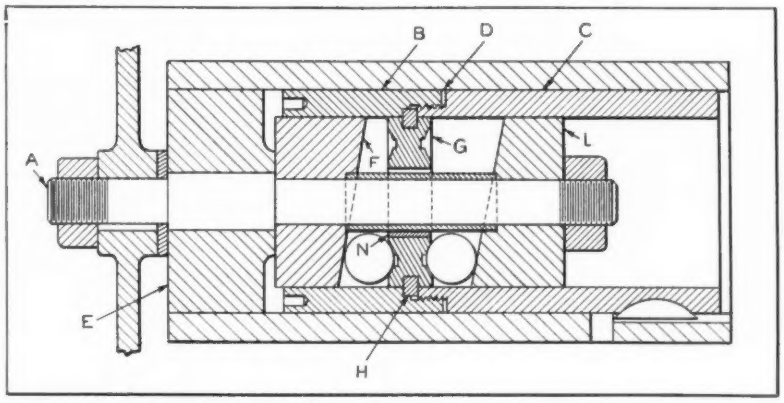
By W. M. HALLIDAY

In the accompanying illustration is shown a mechanism for converting the rotary motion of shaft *A* into a reciprocating motion of the sleeve which is composed of the two members *B* and *C*. This mechanism is similar to one described in April, 1938, MACHINERY, page 535, the principal difference being in the construction of the reciprocating sleeve.

In the mechanism previously described, the snap-ring *H* for transmitting the drive from collar *G* to the sleeve member was assembled by springing it into the groove in member *G*. Member *G* was then pushed into the sleeve until the ring reached the groove on the inside of the sleeve. The ring then expanded into the groove in the sleeve. In order to permit ring *H* to be compressed so that collar *G* could be removed, it was necessary to drill two holes through the reciprocating sleeve, as shown in the cross-section view in the previous article. The diameter of these holes was somewhat larger than the width of the snap-ring and the holes were drilled diametrically opposite each other.

With the design shown in the accompanying illustration, a heavier ring *H* is used and the necessity for drilling holes through the sleeve is eliminated. The ring *H* is fitted into the groove in collar *G*, which is then inserted in member *B* of the reciprocating sleeve so that ring *H* fits snugly into the counterbore. Threaded sleeve *C* is then screwed into sleeve *B*, a clearance of about 0.025 inch being left at *D* so that ring *H* can be clamped securely in place.

The operation of the mechanism is



Mechanism for Imparting Reciprocating Motion to Sleeve Members B and C

the same as the one described in the previous article. Shaft A, with the two truncated cylinders F and L keyed to it, revolves, causing the balls in contact with the truncated faces and the race of collar G to transmit a reciprocating movement to the sleeve members B and C. The balls are kept in alignment by a cage N which straddles the collar G.

The writer believes that ball thrust bearings placed on both sides of the stationary bearing E would be a worth-while improvement.

Mechanism for Clamping and Releasing Spring-Actuated Tailstock Center

By L. KASPER

A mechanism designed for releasing a spring-actuated center and for clamping the center in the work-holding position is shown in the accompanying illustration. The fixture on which this mechanism is used is designed for holding the thin wooden part G, on which a routing operation is performed. The pointed ends of the work are supported on centers, the rear center being located in the block H. Although there is slight variation in the length of the wooden pieces, they must be held firmly in position, but without sufficient pressure to distort them.

Referring to the view to the left, the rack A meshes with the gear B which turns freely on the flanged bushing D, mounted on stud C. The bushing D is slidably keyed in the bearing member J which supports the assembly. Stud C is threaded into the collar F which is fastened to bearing J. Handle E is pinned to stud C and serves to advance it into the threaded collar F. The work G is supported by the block H at the end of rack A. The opposite end of the work is similarly supported by a stationary block. A spring L furnishes the required pressure to support the work.

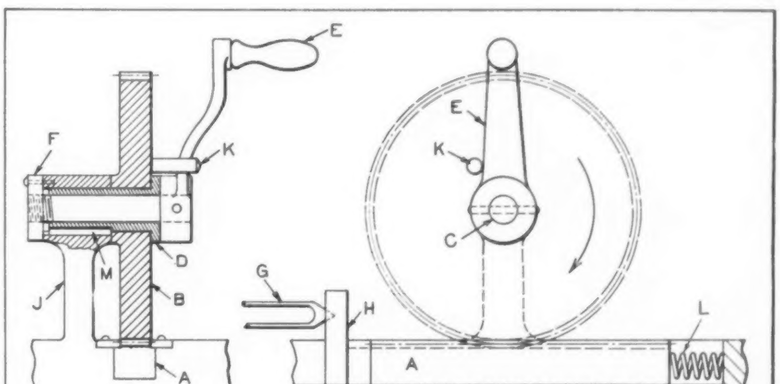
To place a piece of work between centers, the handle E is turned to the left into contact with the pin K in gear B, so that the gear turns with the handle. Then movement of gear B moves rack A to the right. Next, the work is located between the centers and handle E turned to the right, as indicated by the arrow. This permits the pressure of spring L, acting on rack A, to support the work with the maximum permissible pressure. Although this pressure will support the work, it is not sufficient to resist the pressure of the cut and some method of positively locking rack A is necessary.

Continued movement of handle E in the direction indicated by the arrow causes stud C to be screwed deeper into collar F, so that the hub of handle E, acting on the flange of bushing D, locks gear B against the end of bearing J. As gear B now is locked, rack A is prevented from moving. Thus the support H holds the work G in position under the pressure exerted by the cutting tool. As bushing D is restrained from rotating by the key M, the rotary movement of handle E is not transmitted to bushing D, and the endwise pressure applied to the work when it is placed between centers consists only of that exerted on rack A by spring L.

* * *

Automobile Facts and Figures

The 1938 edition of the annual volume giving statistics pertaining to the automobile industry has just been published by the Automobile Manufacturers Association, 366 Madison Ave., New York City. This book of 96 pages contains complete statistical information pertaining to the automobile industry. The production of automotive vehicles, taxes on automobile users, registration fees, automobiles in use for each year since 1895, number of people employed in the industry, etc., are some of the subjects covered.



Mechanism for Clamping and Releasing Tailstock Center

Milling Operations in the Aircraft Industry

Four Examples of Milling Set-Ups for Machining "Baby" Rods and Master Rods

THE principal difference between the machine tool and tooling equipment used in the automobile and the aircraft industries is that, in order to provide for greater flexibility in design changes, aircraft engine and parts manufacturers use a larger proportion of standard general-purpose machines. Even with these machines, however, and proper tooling equipment, high production rates are possible, since the many recent advances in standard machine tool design have increased production possibilities by from 20 to 40 per cent over what was obtainable a few years ago. Better finishes and closer limits of accuracy are also possible because of the greater sturdiness of the newer machines and the consequent freedom from vibration.

The present article illustrates some of the milling operations on aircraft parts performed on different types of milling machines made by the Cincinnati Milling Machine Co. Fig. 1 shows a No. 3 vertical dial type machine equipped with power feed to the vertical head and provided with a standard circular milling attachment for performing several operations on "baby" rods. This equipment is especially suitable for shops having comparatively low production. The fixture shown in the lower part of the illustration holds three rods 120 degrees apart for the first operation of milling four 38-millimeter radii gashes, two near each end of the rod. The inserted-blade cutter shown on the machine table is mounted in the spindle nose, and the power feed to the head is engaged to cut the gashes at the ends on three rods at one setting. The rods are then turned over to mill the gashes on the other side; the operation is repeated for the two gashes at the other end of the rods. The production is 13.4 pieces per hour, exclusive of the fixture set-up time.

The fixture shown on the power-feed circular milling attachment in the same illustration holds the work for the circular milling of the ends of the rods. The first operation is to rough-mill one end of the rod from gash to gash, using the helical end-mill shown on the machine table. The operation is then repeated on the other end of the rod, but a different machine setting is required in this case. The cutter shown in the machine spindle also rough-mills clear around each of the four bosses on each rod, thus making four additional settings necessary, or a total of six settings of the work to completely rough-mill both ends of the rod. The production is 2.9 pieces per hour for all six settings, exclusive of the set-up time.

Fig. 1. Equipment Used for Gashing and Milling the Ends of Airplane Engine Baby Rods

Fig. 2 shows a duplex Hydromatic machine fitted with auxiliary equipment for milling the channels in baby rods. The auxiliary equipment consists of a special handwheel arrangement to move both machine quills at the same time, so that the end-mills can be used to bore out the ends of the channel. Levers are added to lock the machine quills from the operator's position while a cut is being taken with the machine table feed. A special double positive stop arrangement shown in the foreground quickly locates the table in position when boring out the ends of the channel. A clamp is included to prevent the table from moving when boring cuts are being taken by hand.

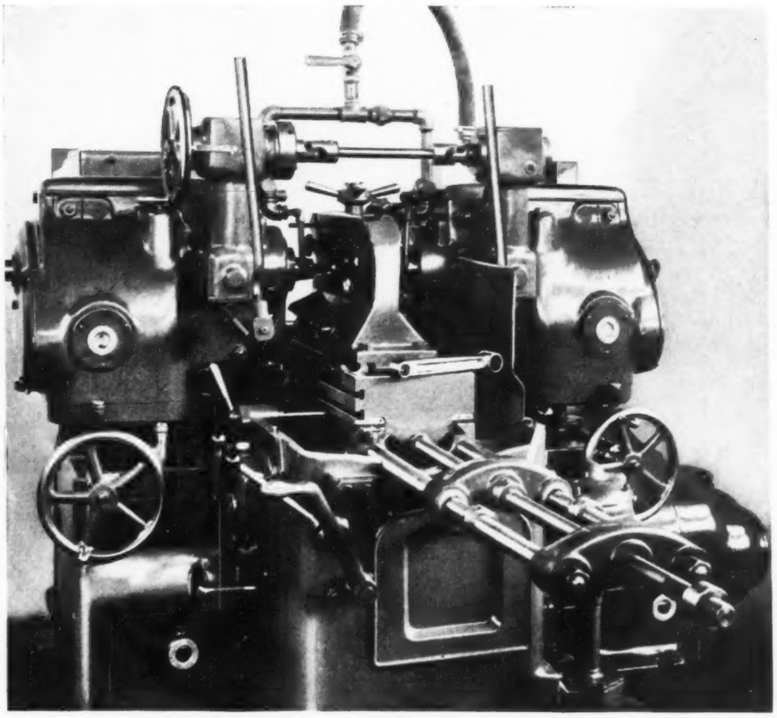


Fig. 2. Machine Set-up for Milling the Channels in the Sides of Airplane Engine Baby Rods

The work is located from previously bored and faced end bosses, the center portion being supported by adjustable supports, and it is clamped over the top of the channel by means of the pilot wheel on the top of the fixture. The table is set to the proper position and locked in place for boring one end of the channel to depth from both sides. The quills are next withdrawn by hand, the table advanced to the opposite end of the channel, and another boring cut taken. Then the table is unlocked and the table feed is engaged to mill the channel.

After the piece has been milled as described, the quills are withdrawn, the table is returned to the loading position, and the finished piece is removed. A safety provision prevents the table rapid traverse from being engaged when the quills are moved into the milling position. Two complete operations are performed; one rough-milling operation and one finishing operation. The production is at the rate of 6.1 rods per hour for rough-milling, and 7.7 rods per hour for finishing. The channel slots are forged to within approximately 1/8 inch of the finished size.

Fig. 4 illustrates a different method of milling the channels in baby rods. In this case, a standard knee-and-column type machine fitted with a two-spindle vertical attachment is used instead of the fixed-bed Hydromatic machine with special equipment just described. The knee-and-column type machine is not so rapid, but it can be easily changed over for the performance of any general-purpose milling operation.

To facilitate the set-up, the outer spindle housing is adjustable along the machine over-arm, and the spindle in this carrier can be adjusted vertically by means of a quill arrangement. A fixture on the table holds two rods at one time. The sequence of operations is as follows: Raise the knee to the proper depth of cut, engage the power table feed and mill the channel, trip the feed, lower the knee, reverse the work in the fixture, and repeat. The production is at the rate of 5.2 pieces per hour for one cut.

Two other milling operations on this rod are also performed with the same equipment. After rough-milling, the rods are heat-treated and then returned to the machine for milling the sides, using a helical end-mill. Several intermediate machining operations are performed on other machines and then the rods are returned for finishing the channels.

Fig. 3 shows a vertical dial type machine arranged for the rotary profile milling of master rods. The machine is equipped with a special rotary

Fig. 3. Rotary Profile Milling of Master Rods, Using a Special Rotary Milling Table

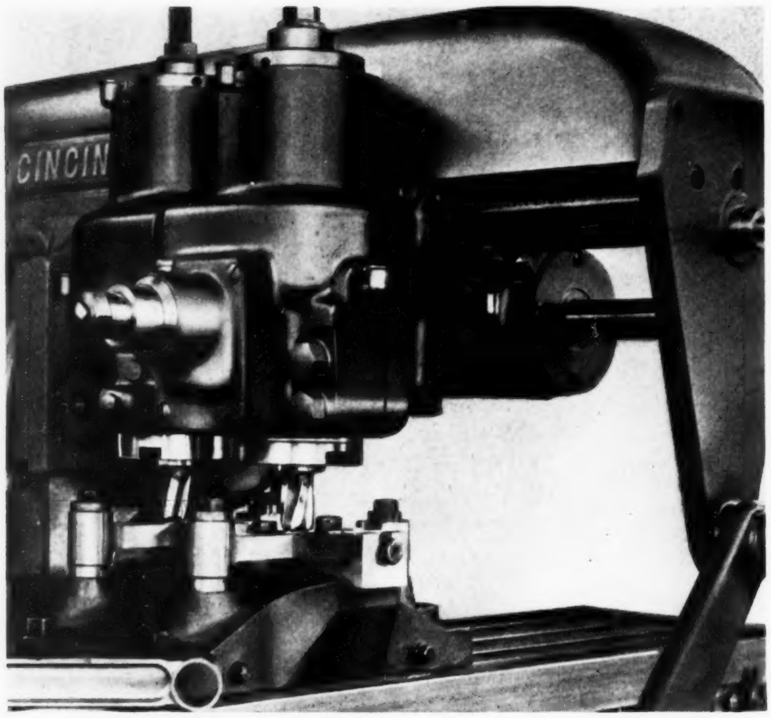


Fig. 4. Milling the Channels in Baby Rods on a Standard Knee-and-column Type Milling Machine

milling table which replaces the standard saddle and table. A special arbor support, fastened to the lower end of the vertical head, supports the lower end of the helical cutter. At the rear of the intermediate slide are two hold-back air cylinders. The piston-rods from these cylinders are fastened to the upper slide which supports the rotary table and master cam. As the table rotates, the pistons, through a roller-and-link mechanism, move the upper slide toward and away from the cutter, producing a contour on the work that duplicates the contour on the master cam.

These master rods are made from chromium-nickel steel having a hardness of approximately 340 Brinell. The maximum amount of stock removed is about 0.090 inch. The time required for milling is approximately 22 minutes for each rod.

* * *

Who Is Responsible for Popular Fallacies About Industry?

We all know that there are a number of popular fallacies in regard to the operation of industry, such, for example, as the fallacy that machines put men out of work, and hence that the machine is an enemy rather than a useful tool of the worker.

Of course, the immediate cause of the persistance of these fallacies is that they have been repeated again and again by men in high public office, by labor leaders, and by radicals whose avowed purpose it is to stir up strife because they believe that in that way they promote the coming of an industrial revolution, which is their panacea.

On the other hand, what has industry done—what have employers done—to set the workers right in regard to these fundamentals? In a booklet by Paul W. Garrett, director of public relations of the General Motors Corporation, entitled "Public Relations—Industry's No. 1 Job," the author asks "Have not you and I unwittingly allowed influences to seep into our land that will destroy our American standard of living unless we correct some public misconceptions soon? Have we not allowed concepts to grow up that are a threat not alone to capital, to labor—to industry big and small—but to the well-being of the American consumer himself? Is it not a challenge to you and me to deal with the job of meeting these present-day fallacies?"

Mr. Garrett lists these fallacies and urges employers to combat them by providing explanations and correct information to their workers and the public. Among the fallacies listed are the following: (1) The assertion that industry is a device operating for the benefit of a few economic royalists, thus setting up class hatreds; (2) that business went on a "sit-down" strike to bring about a depression to embarrass the New Deal and to embarrass labor; (3) that the way to create buying power is to level down purchasing power from the top—that the way to get wealth is by dividing it, not by producing and multiplying it; (4) that the machine is driving men into idleness; (5) that the salary of the boss comes out of the workers' pockets; (6) and the fallacy of fallacies—the strange belief that bigness in industry is synonymous with badness, as if size had anything to do with the moral character of the managers of the business.

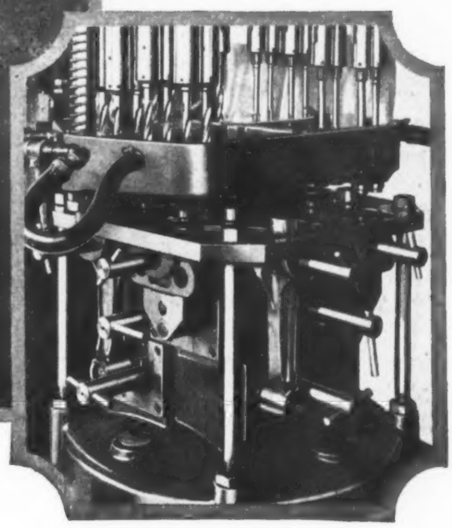
If American industry, by constantly placing within the reach of the worker a better way of living, has helped to give the world the highest standard of living in history and has created the greatest nation of consumers in the world, why should industry hesitate to take credit for this, to tell the story, and to resent vigorously any statements to the contrary?

In conclusion, Mr. Garrett emphasizes that good relations between industry as a whole, consumers, and labor, must grow from good relations inside of each plant. If there is any secret to the success of building good public relations, it is that each employer must begin at home and work from the inside out. "Begin," he says, "in your own plant if you want to be well thought of in the community."

* * *

Of the approximately 43,000,000 motor vehicles in the world today, about 70 per cent are registered in the United States.

Design of Tools and Fixtures



Die for Piercing Four Holes Simultaneously

By FRANK HARTLEY

The automatic die with opposed inward-sliding punch units shown in Fig. 2 is designed for piercing four holes simultaneously in the flanges of a long sheet-metal, box-shaped member which is fed along intermittently between the punch units. The punch units are withdrawn automatically from the position indicated by dimension *U* to that indicated by dimension *T*, so that projections such as shown at *G* can pass the die units. The box-shaped member *W* is made up in strip form from two channel members *P* in combination with two side plates *E*.

The four piercing punches *X* are advanced from the positions shown in Fig. 2 to the positions shown in Fig. 1 for punching the flanges, and then withdrawn automatically. The view Fig. 1 shows only one of the sliding head units advanced to the piercing position, with the punches at the ends of their piercing strokes.

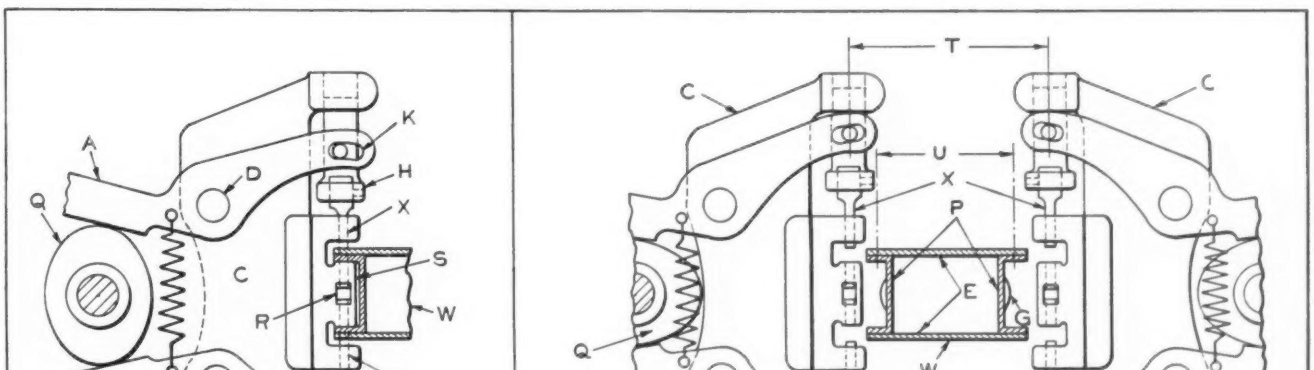


Fig. 1. Piercing Unit of Die with the Punches at the Ends of Their Strokes

Fig. 2. Die with Piercing Units Withdrawn to Permit Intermittent Feeding of Work to Successive Positions

The mechanism for operating the punches is composed of levers *A* and *B*, Fig. 1, fastened to a movable bracket *C* by means of bearing studs *D*. Levers *A* and *B* are actuated by opposite sides of the cam *Q*, being held in contact with the cam by a coil spring. Pins in the punch-holders *H* and *J* pass through slots *K* and *L* in the ends of levers *A* and *B*. This construction permits levers *A* and *B* to actuate the punches, causing them to pierce the work and enter the die-block *S*, which is attached by means of screws and dowels to the bracket *C*. The slot at *R* allows the piercings to pass through the die-block and out at its sides.

The heads are brought together, or into the piercing positions, by means of the plate *V* which is rotated or oscillated by the shaft *F*. Links between the plate *V* and the heads serve to bring the heads into and out of the piercing positions.

Both the operation of the piercing punches and the movement of the heads are synchronized with the mechanism that automatically advances the work during the intervals between the piercing operations. The work pierced is only a few thousandths inch thick, although from the cross-section views it would appear to be much thicker.

Dies for Forming Steel Lamp Base

By M. J. GOLDSTEIN, New York City

The drawn steel shell of conical shape shown at *B*, Fig. 1, is formed in two operations on dies designed as indicated by the outline views in Fig. 2. This shell serves as the base of a lamp, and is drawn to the shape shown from 22-gage (0.025 inch thick) sheet-steel blanks 8 1/2 inches in diameter. As it is difficult to hold a steel blank of this size and gage properly during the forming operations in a single-action press, the dies were made for use in a heavy drawing press.

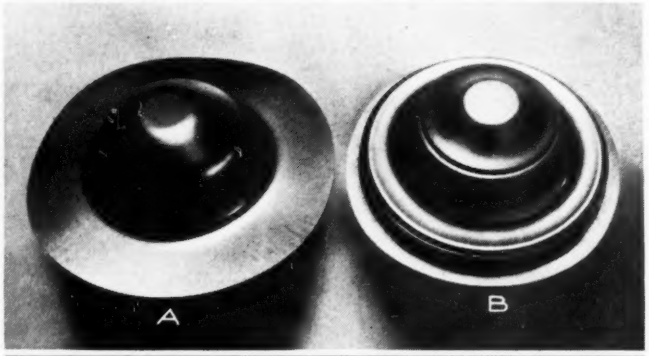


Fig. 1. Two Steps in Forming Steel Shell for Lamp Base

The shell formed by the first operation is shown at *A*, Fig. 1, while the die employed is shown at *A*, Fig. 2. The die and blank-holder are made of tool steel and are set in cast-iron shoes. The punch is made of cold-rolled steel. Air is allowed to escape through the drilled holes shown by dotted lines. The die is finished to a radius of 1/2 inch at the drawing edge to correspond with the form of the finished shell. This large radius makes it possible to draw the shell to a depth of 2 1/8 inches. This is considered quite an accomplishment, especially as the punch is 3 3/4 inches in diameter, which is less than half the blank diameter. Of course the blanks drawn are a good grade of deep drawing steel.

The die for the second or finishing operation is shown at *B*, Fig. 2. The die body is cast iron and has a tool-steel ring for the top facing. The blank-holder is cast iron. The punch is cold-rolled steel and has a standard 1 3/8-inch thread by which it is attached to the press. The inserted die member is machined with a recess of the same shape as the work and acts as a knock-out for raising the finished shell from the die. The shell produced by the first operation is an easy fit in the recess in the finishing die. Pressure is applied to the flange of the shell by the blank-holder, which is fastened to the outer ram of the press, the pressure being adjusted by proper setting of the nuts on four adjusting screws. The punch is attached to the center ram of the press and is adjusted the same as in an ordinary press.

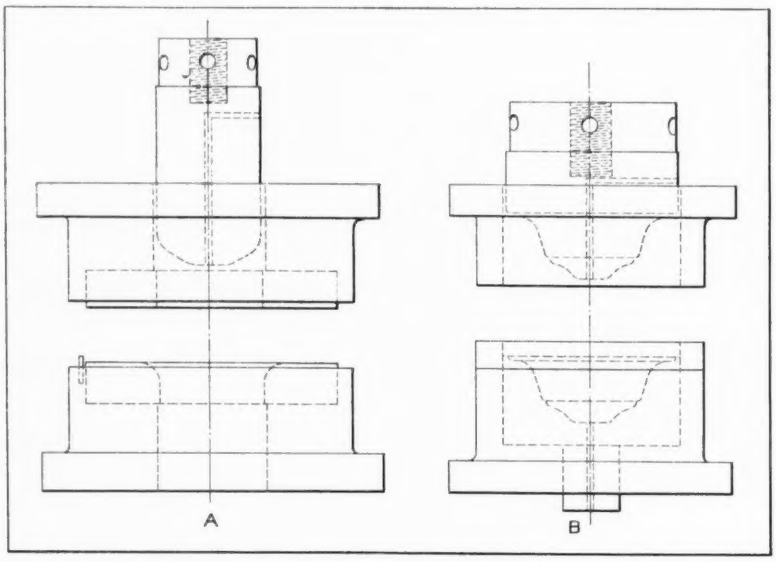


Fig. 2. Dies Used in Forming Steel Shells for Lamp Base Shown in Fig. 1

After it has been drawn, the shell is trimmed on an ordinary trimming die. It is centrally located on the die by a pad, and pressure is exerted by means of four pins and a rubber buffer. The shell is trimmed with the small end upward. Clearance is provided in the punch, and the cutting edge of the punch is chamfered, so as to give a slight rounding to the bottom edge of the shell. This chamfer starts the curl on the edge of the shell, which is completed on a trimming and beading lathe by a high-speed steel roller having a ground and highly polished groove. After perforating the

rim of the shell, inserting a brass eyelet for the electric wire, and applying the required finish, the shell is ready for assembling with the pedestal or supporting member through which the electric wire is led to the lamp socket.

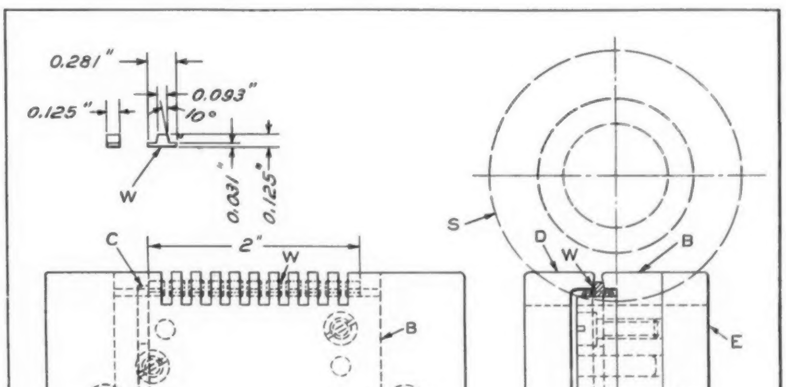
Multiple Cutting-Off Fixture with Quick-Unloading Jaws

By C. COLE, Dayton, Ohio

In the accompanying illustration is shown a fixture designed for use in cutting large quantities of formed rods into eleven pieces simultaneously, using a gang of ten saws. The saws *S* are 1/16 inch thick and are spaced by nine washers 0.125 inch thick. The small size of the pieces *W* made it a rather tedious job to unload them one at a time from a fixture of the usual type. The problem was solved, however, by the fixture shown in the two views of the illustration.

The stock, which has the form shown at *W*, is first cut to a length of 2 inches. The fixture has a movable jaw *D* and a stationary jaw *E* into which pins *A* are driven. The pins *A* serve as locators for the removable locating and holding block *B*. This block is made in two pieces to facilitate construction. It can be readily seen that if the stationary jaw *E* were solid, each of the pieces *W* would have to be removed from the jaws separately. In doing this, some of the parts would be likely to fall to the bottom of the device. With the removable locating and holding block *B*, the unloading problem is solved by merely removing the block and tumbling the pieces into a box.

The method of loading the work in this type of fixture is the same as for any standard milling vise jaws. Block *B* is placed against the stationary jaw on the pins *A*, after which the work is set in place against the pin *C* and is then clamped securely by means of the regular milling vise in which the cutting-off fixture is mounted.



Fixture Used in Cutting 2-inch Lengths of Formed Stock into Eleven Pieces

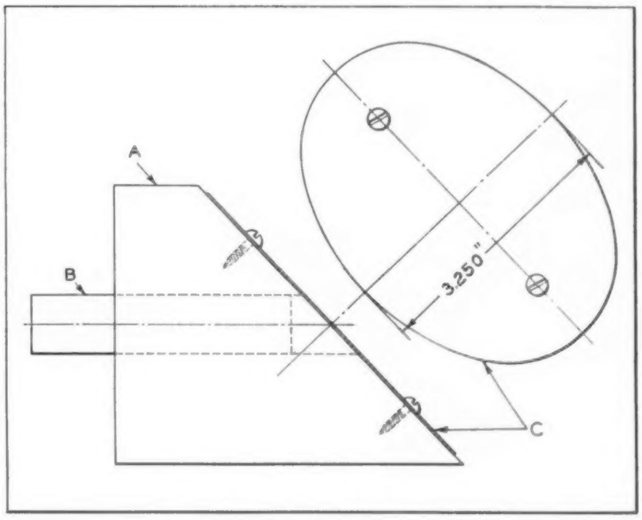


Diagram Illustrating Method Used to Produce Accurate Templet of Elliptical Shape

Shop Method of Making Accurate Ellipse Templet

By GEORGE WILSON, Marshalltown, Iowa

The accompanying illustration shows how a problem in geometry involving the production of an accurately laid out ellipse was solved in the shop. A quantity of cast shells about 5 inches in length had been bored to a diameter of 3.250 inches, plus or minus 0.001 inch, in which a butterfly valve of elliptical shape was to be assembled. The castings were machined in a turret lathe, using special jaws in a two-jaw chuck. A four-tool boring head was used to remove all but 0.006 inch of material, which was allowed for finishing with a floating shell reamer.

The butterfly valve was made from sheet brass stock 0.040 inch thick, and was required to be a close fit in the bored hole of the shell. The die for producing the brass butterfly member had been made up and one of the stampings from the die was forwarded to the shop for use as a trial gage in the bore of the shell. As the shells varied considerably in roundness and were quite thin, it was difficult to hold the bores to the desired accuracy. The shells were distorted slightly under the clamping pressure of the chuck, so that when released they were out of round about 0.001 inch at one end. The variation in diameter was also a little more than allowed in the specifications.

The customer objected to the amount of variation, claiming that the fit between the butterfly and the shell must be closer. The shop contended that the shells were sufficiently accurate and that the trouble was not in the variation of the bores, but in the contour of the brass butterfly. On the other hand, the customer claimed that the butterfly had been made very accurately.

To prove its contention, the shop produced a butterfly which fitted the bore of the shell properly. This was done in the following manner: A wooden cylinder *A* was turned, bored for mandrel *B*, and cut at the angle at which the butterfly member was to be set when in the closed position in the bored shell. A sheet-iron blank *C* was secured to the angular face of the wooden block with screws. The mandrel was gripped in the collet of a lathe, and a toolpost grinder was used to shape the piece as it rotated in the lathe, using the regular longitudinal feed. With the butterfly member produced in this way, it was shown that the shells were bored with sufficient accuracy to meet requirements and that the previous trouble had been in the contour of the blanked butterfly.

Device for Centering Work in Lathe Chuck

By JOSEPH WAITKUS, Wellesville, N. Y.

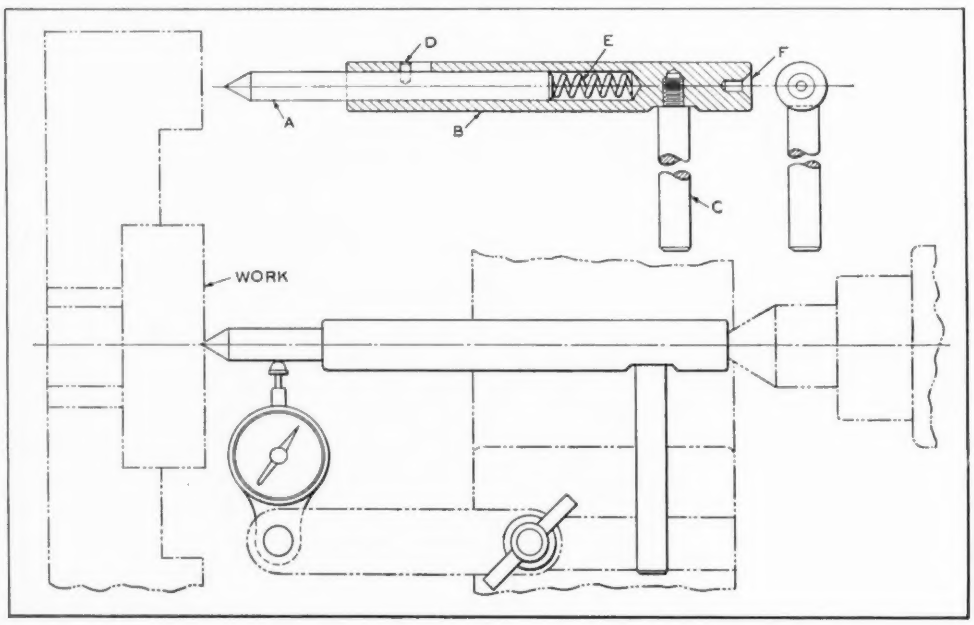
In drilling holes in blank pieces held in a lathe chuck, it is often difficult to center the work in the chuck. If the work is of irregular shape, the problem of bringing the punch mark that indicates the location of the desired hole into accurate alignment with the drill or the axis of the lathe spindle becomes even more difficult. This work, however, is greatly simplified by the use of an easily made device, which is constructed as shown in the accompanying illustration.

The rod *A* of this device is an easy sliding fit in the holder *B*. Handle *C* is fastened to the holder. Pin *D*, which is fastened to the rod and is free to slide in a slot in the holder under the action of spring *E*, serves to retain rod *A* in the proper position in holder *B*. The end of the rod is accurately pointed and hardened, while the end of the holder is provided with a center hole at *F*.

The center in the tailstock is set in the center hole *F*. The point on rod *A* is set in the punch mark representing the center of the desired hole in the work. When these two points at opposite ends of the device are set, the tailstock center is advanced a little to compress spring *E*, so that the device will be held more firmly between the two supporting points. Handle *C* is set so that it rests on the cross-slide and serves to keep the device from rotating when the faceplate or chuck is revolved. A dial gage is fastened to some stationary part, such as the cross-slide, and is set to bear on rod *A*.

The use of the device shown is quite simple. As the chuck is rotated by hand very slowly, any eccentricity in the position of the center in the work with respect to the center in the headstock will be indicated on the dial gage. The aligning of the work is then simply a matter of adjusting the chuck jaws until the dial gage indicates no movement, showing that there is zero eccentricity and that accurate alignment between the center in the blank piece and the headstock center has been accomplished. The equipment can then be removed and the center in the headstock can be replaced by a drill for performing the drilling operation.

The device described permits more accurate location of the work and is well adapted for use in performing accurate drilling operations, such as are required in certain tool and die work.



Simple Device for Aligning Punch Mark with Lathe Spindle for Drilling Operation

* * *

New Motor and Generator Standards

A new standards publication has been published by the National Electrical Manufacturers Association, 155 E. 44th St., New York City. This publication, entitled "NEMA Motor and Generator Standards, Publication No. 38-49," supersedes the previous edition of these standards (Publication No. 34-22), which was published in 1934. The present book contains all the information of the previous edition, somewhat modified and augmented. Some of the new material published in this book includes temperature ratings of various types of enclosed motors, standardized lettering for flange-mounted motors, method of measuring motor vibration, etc. Copies of this publication can be obtained from the Association, at the address given in the foregoing, for $2 a copy.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

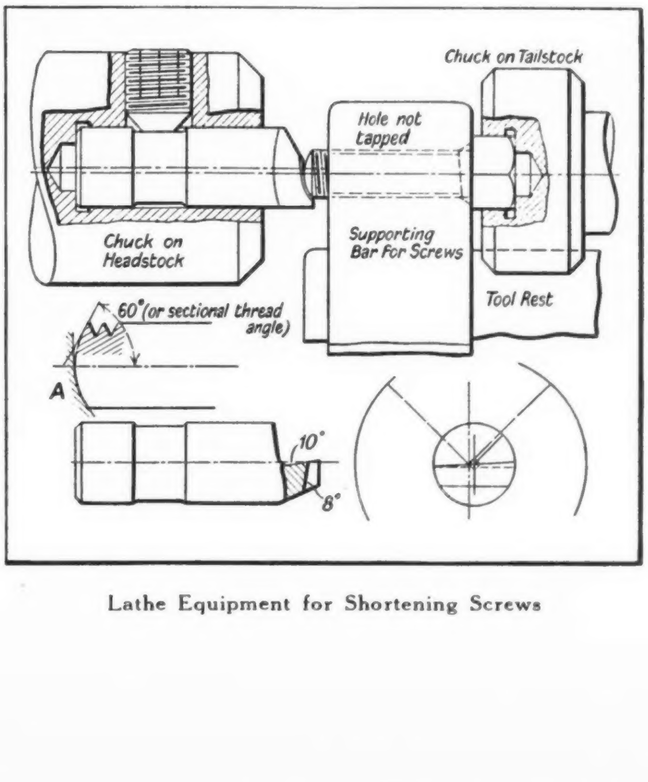
Shortening Hexagonal-Head Screws

C. R.—What is the quickest and best method of shortening by about 1/16 to 1/8 inch, bright hexagonal-head screws? The diameters are 3/16, 1/4, 5/16, and 3/8 inch, and the lengths range from 11/16 inch up to about 2 3/8 inches. For example, how could a 15/16-inch length screw be reduced to 7/8 inch quickly, and without spoiling the thread?

A.—It is unlikely that quantities will warrant fully- or even semi-automatic equipment, otherwise the screws would have been made originally to the proper length. Hand-operated lathe equipment such as that illustrated should be speedy and capable of shortening screws at the rate of one every few seconds.

The screw is inserted in a hexagonal recess in a floating chuck held in the tailstock of the lathe. It is preferable that the lathe have a lever-operated tailstock. The cast-iron screw-supporting bar, drilled in position from the headstock spindle, should not be tapped, but would best be reamed so as to be a good, but not tight, fit for the screws. The cutter fits eccentrically in a special chuck held in the headstock spindle, the eccentricity being intended to allow the cutting edge to be located so as to avoid leaving tips on the ends of the screws.

A cutter shaped as at *A* produces a rounded end on which the top of the thread "spirals" in a complete turn from the crest down to the root, obviating frays if the feed is reasonably fine, as it should be to obtain a good finish. The cutting speed at the outer edge of the cutter should be at least 150 feet per minute for steel and 300 feet for brass. Steel should be cut under an ample flow of coolant. Brass should be cut dry. For brass, the top rake shown on the cutter is not needed; in fact, a little negative rake would be best.



Lathe Equipment for Shortening Screws

Equipment following similar lines could be devised for use on almost any machine with a rotating spindle, as on a drilling machine, for instance. Although time would be lost in stopping the spindle, the screws might possibly be mounted in a similar manner in a rotating spindle, the cutter remaining stationary.

F. S.

Condemnation of Shop for Public Purposes

I. C. A.—The city intends to compel us to sell our plant, so that it can be demolished to make way for a viaduct. Can it do this, or can we prevent it?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

The law of condemnation permits a municipality to appropriate private property for public purposes, such as for the construction of a viaduct. However, the city is bound to pay a reasonable price for the property, plus any and all incidental damages which may be sustained by the property owner. If you are unwilling to accept the offer for your property submitted by the municipality, you may resort to the courts and prove the valuation of the property plus the damages sustained to your business and additional expenses resulting from the necessity of moving. This case would be tried before a jury who, after considering all testimony, would render a verdict based upon the testimony that you present to sustain the reasonableness of the amount that you think the city should pay you.

* * *

Evening Courses for Graduate Engineers

In order to give young graduate engineers who are employed an opportunity to take post-graduate courses at the Stevens Institute of Technology, Hoboken, N. J., the Institute will offer, during the 1938-1939 academic year, a number of evening graduate courses. Each course will carry credits leading to the degree of Master of Science. The courses will begin September 26.

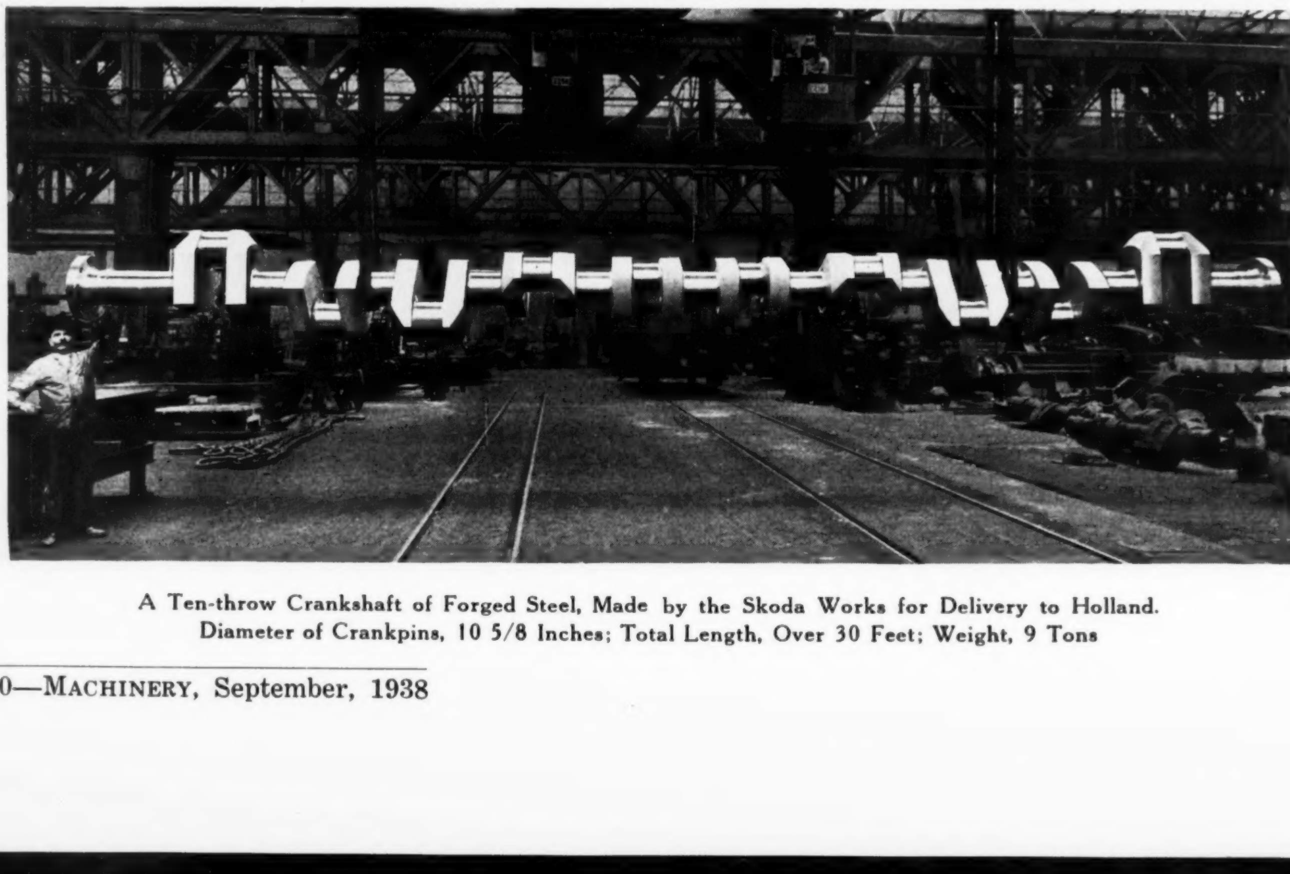
Some Products of the Great

Partial View of the Plzen (Pilsen) Plant of the Skoda Works—One of the Largest Manufacturing Plants in Europe

MOST American manufacturers and engineers in the mechanical industries know that the Skoda Works are one of the great mechanical enterprises of the world, but not all are familiar with the unusually large variety of products manufactured by this company and the prominent position that it occupies in more than a dozen branches of the machine-building and metal-working industries. Many perhaps were first impressed by the importance of the Skoda Works during the World War; they think of Skoda as a huge armament plant. Since the war, however, these works have resumed and greatly amplified their position in the manufacture of all kinds of engineering equipment for peaceful purposes.

The Skoda Works include a great many plants in various parts of Czechoslovakia, the main works being located at Plzen (Pilsen). The engineering history of this city runs back well over 150 years, the Ringhoffer Engineering Works having been founded in 1771, followed by the establishment of many other metal-working plants. In 1866, Emil Skoda became the manager of one of these Plzen plants, which then employed only thirty-three men. Three years later, in 1869, he purchased the business and laid the foundation for the Skoda Works, which today employ over 50,000 people.

The first question that an American engineer is likely to ask is, "What do the Skoda Works make?" It would be almost easier to enumerate the products in the engineering field that these works do *not* make; and yet, in spite of the diversified products of the company, the business is so organized that the enterprise consists of an aggregation of in-



A Ten-throw Crankshaft of Forged Steel, Made by the Skoda Works for Delivery to Holland. Diameter of Crankpins, 10 5/8 Inches; Total Length, Over 30 Feet; Weight, 9 Tons

Skoda Works of Czechoslovakia

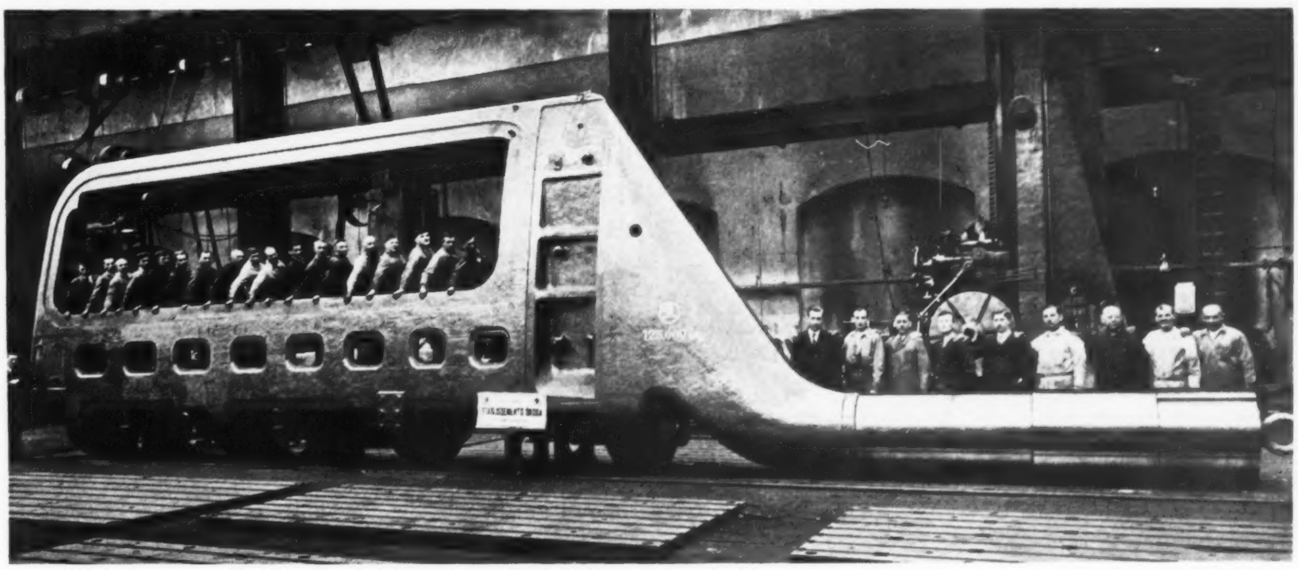
A Group of 18-inch High-speed Thread-cutting Lathes—One of the Lines of Machine Tools Made by Skoda Works

dividual shops, each specializing in one product. In Plzen, for example, where the main manufacturing plants of the company are located, there are, among others, separate shops for making electric generators and motors, for completing a steam or electric locomotive every working day in the year, for making cream separators and dairy machinery, and for building Diesel and gas engines up to 10,000 horsepower units. More than 14,000 stationary boilers of different types and sizes have been built in the boiler works, and more than 8000 stationary steam engines have been delivered to various parts of the world.

In the early days, the company found it necessary in many instances to build its own machine tools, and gradually it became a factor in the machine tool industry. Today the Plzen plants include a machine tool shop employing some 500 people and a small tool shop employing about 300 people. Thus, while the Skoda Works manufacture equipment for almost every engineering field, the aim has been to manufacture similar types of machines in highly specialized factories, grouped together under a common management.

Furthermore, the company maintains a complete engineering service, placing it in a position to take contracts for entire plants. If a sugar mill, a brewery, a power plant, a cement mill, an oil refinery, or a paper mill is required in any part of the world, the Skoda Works will take the contract to erect and equip the entire plant.

Apart from the complete engineering products manufactured, the Skoda Works are famed for their foundries and forge shops, where castings and



The Rudder Frame for the Giant French Liner "Normandie," Made by the Skoda Works. The Total Weight of This Rudder Frame, Assembled as Shown, is 125 Tons

forgings weighing up to 75 tons are made in a single piece. Many heavy castings and crankshafts have been delivered for some of the giant ocean liners, including the *Normandie* and the *Bremen;* and even some of the largest ocean liners built in America are provided with crankshafts forged in the Skoda Works. The total annual capacity of the foundries and forge shops is about 200,000 tons; forgings of 2 1/2 tons each or less can be produced at the rate of 50 tons a day.

Another specialty is that of gears of all sizes, as well as axles and wheels for locomotives and railway cars. The shop doing this work has a capacity for producing 12,000 pairs of wheels and axles annually, which are exported to many parts of the world.

A few figures selected at random, as given in the preceding paragraphs, indicate in a general way the size and scope of these great Czechoslovakian works and give a general idea of the diversification of their products.

* * *

Finishing Cages for Roller Bearings by Broaching

Cages for roller bearings on some of the new streamline Diesel trains are now being finished by broaching. This is particularly interesting because broaching is generally considered more or less of a mass-production operation, and these parts are used only in comparatively small quantities.

A fixture and broach set-up was developed to permit the broaching of several sizes of cages having inside diameters of from 9 to 13 inches with the same machine and fixture. In addition to varying in size, the cages also vary in the angular contact of the rollers.

The set-up shown in the accompanying illustration is used for broaching the openings in the cages. The construction was such that it was impossible for the broach to pass entirely through the parts. Strip broaching was, therefore, resorted to, using a rectangular broach, which is pushed through the cage opening and returned to the top of the stroke in a single cycle. At the end of each cycle, the part is rotated to the next opening around the axis of a locating pilot.

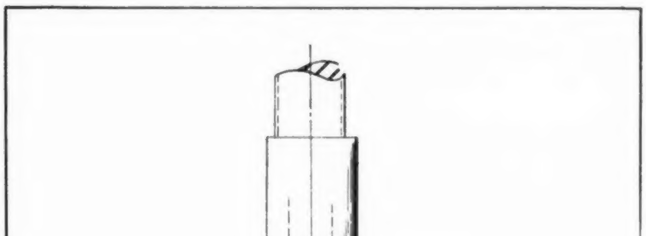
While the sizes of the openings had to be held to close limits, the spacing between permitted tolerances that made it possible to use the broach pilot itself for indexing and locating the part. This was facilitated by guide slots for the broach in the top of the fixture, close to the part itself, and by providing for lost motion between the ram and the broach.

The main part of the fixture is pivoted, as indicated, to accommodate different roller contact angles. Adapter plates and angle locating blades are provided for the different sizes. This method has proved effective and might be applied to other cases where different sizes of similar large parts are required in small quantities.

Exports of Industrial Machinery Continue to Increase

The exports of industrial machinery from the United States during the month of June, according to the Machinery Division of the Bureau of Foreign and Domestic Commerce, increased 16 per cent over the corresponding shipments in June last year. The value of the shipments this year was $23,203,000. For the first six months of 1938, the machinery exports have totalled $142,216,000, which is an increase of 28 per cent over the corresponding figure for the same period last year.

In the machine tool and power-driven metal-working machinery fields, the increases were even more marked. During the first six months of the year, power-driven metal-working machinery was exported to a value of $49,052,000, an increase of 77 per cent. The outstanding increases in this group were noted in lathes (including turret lathes), milling machines, planers, shapers, surface grinders, external cylindrical grinders, sheet and plate metal-working machinery, forging machinery, and foundry and molding equipment. Greatly increased shipments to Russia and Japan have been a major factor in the continued improvement in machine tool exports.



Broaching Roller-bearing Cages in Fixture Permitting Cages of Different Sizes and Angles to be Accommodated

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Large Sheet-Metal Blanking, Forming, and Drawing Dies —Seventh of a Series of Articles

By CHARLES R. CORY*

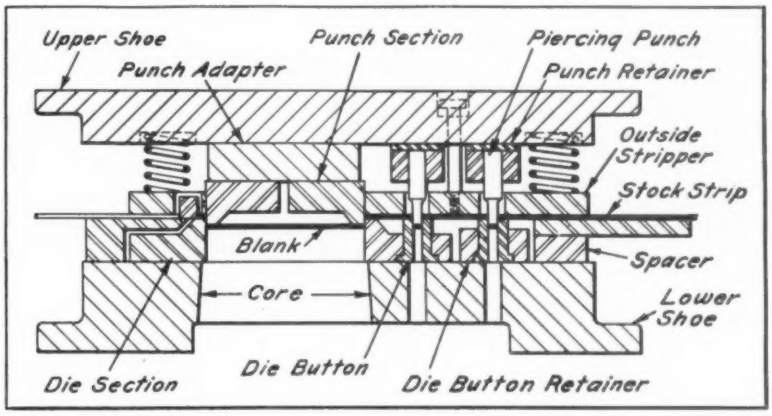


Fig. 1. General Arrangement of a Progressive Type Blanking and Piercing Die

THE fifth and sixth articles in this series, published in the June and August numbers of MACHINERY, dealt with blanking and piercing dies of the compound type. The present article will deal with the progressive type of blanking and piercing die. This type of die performs the piercing and blanking operations in two separate stages. The holes in the blank are pierced at one stroke of the press. The stock strip is then fed forward through the die and the part is blanked at the next stroke of the press. Although it takes two strokes to finish a blank, it is obvious that after the die is in operation a blank will be completed at every stroke, because one part is being pierced while another part, already pierced, is being blanked.

The blanking stage of a progressive type of blanking and piercing die resembles the drop-through type of blanking die. The blank, when sheared from the stock strip, travels down through a hole in the die. The piercing punches are fastened to the upper shoe, or punch-shoe, at the piercing stage. The pierced slugs travel down through die buttons mounted on the lower shoe, or die-shoe.

This type of die may have more than two stages. For example, there may be an advantage in having two stages of piercing followed by the blanking stage. In that case, it requires three strokes of the press to complete one part. Nevertheless, since each of the three stages completes its operation on a different part at each stroke, a blanked part, properly pierced, is produced at each stroke of the press.

*Die Engineer, Fisher Body Division, General Motors Corporation, Detroit, Mich.

The arrangement of a progressive type blanking and piercing die is indicated in Fig. 1. The blanking die sections should not include the piercing die holes or die buttons for the piercing stage, unless it is necessary to so construct the die. Both the blanking and the piercing dies will be more easily replaceable in case of breakage if the blanking and piercing are done in separate die sections. In the piercing stage, die buttons should be used for holes less than 1 inch in diameter, if the production during the life of the die is high. The blanking and piercing dies do not require an adapter, but are generally fastened directly to the top surface of the die-shoe.

One reason for using a progressive rather than a compound type of die is to insure a strong blanking punch. In the compound type, the punch is sometimes seriously weakened by the die holes for piercing. If the pierced holes are very close to the blank edge, a progressive type of die should be used, so that the piercing die holes will not be in the blanking punch at all, but in the die sections, which are not weakened so much by the addition of the die holes. When a sectional punch is used, the punch sections are fastened to a punch adapter. If the part is small enough so that the punch can be made from one piece of steel, it may be fastened directly to the punch-shoe.

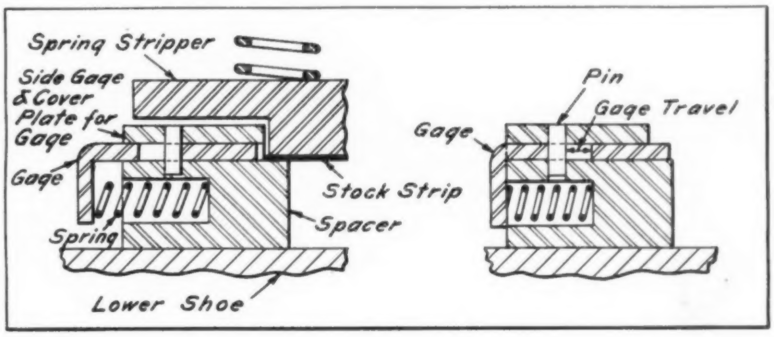


Fig. 2. Preliminary Gage for Use when the Die Has Three or More Stages

The outside stripper may be either a floating stripper or a solid stripper. The

floating type is operated by springs and is fastened to the punch-shoe. The stripper keeps the stock strip down on the dies on the up stroke of the press until the blanking and piercing punches are stripped out of the stock strip.

The solid type of stripper is a plate located above the stock strip. It is fastened to the die-shoe and bridges over the stock strip. On the up stroke of the press, the stock strip moves up with the punch until it comes in contact with the solid stripper, when it is stripped off the punch.

If a solid end-gage pin is used, the vertical gap between the die sections and the solid stripper plate must be large enough to permit lifting the stock strip over the end-gage pin prior to feeding it to the next operating position. With a trigger type end gage, this vertical gap may be somewhat less than twice the stock thickness, so that a new stock strip will not jump over the end of the nearly finished strip.

Gages Used in Connection with Progressive Type Dies

The stock strip is gaged along one side and at the end. The operator feeds the stock against the end gage while keeping it in contact with the side gages. The side gages may consist of a side-gage bar on the stock support and one or more side-gage pins. One end-gage pin is used for a narrow stock strip and two for a wide one. The end gage comes in contact with the near side of the hole in the stock strip from which the preceding part has been blanked.

It is obvious that in a progressive type of die the operator must feed a new stock strip into the die only far enough to be pierced. On the second stroke and on all strokes thereafter, the stock is fed against the regular end gage and the pierced stock is blanked. The operator sight-gages a new stock strip when it is fed into the die for the first piercing, so that the strip extends a short distance past the nearest cutting edge of the blanking die. When the die closes, a small piece of stock will then be cut off the end of the new stock strip when the holes are pierced. For the second die stroke, the stock strip is fed against the regular end gage, which will then operate against the edge of the partially blanked hole that was produced at the first stroke of the die.

If the die has three stages, it is necessary to use preliminary gages for the first two die strokes on a new stock strip. A preliminary gage is a gage ordinarily inoperative, which can be brought easily into operation for the first and second stage operations on a new stock strip. This gage has the same position relative to the stage it gages that the regular end gage has to the blanking stage. The operator puts the first preliminary gage into the operating position manually and feeds the new stock strip against it for the first die stroke on the new strip.

For the second die stroke on the new strip, the first preliminary gage is allowed to move out of the way and the second preliminary gage is put into the operating position, against which the stock strip is fed. For the third die stroke and all succeeding die strokes, the first and second preliminary gages are in the inoperative position and the stock strip is fed against the regular end gage. If the die has four stages, three preliminary gages are required.

One type of preliminary gage consists of a plate sliding sidewise into the path of the stock strip. The gage is guided in a channel and a light spring keeps it in a position where it clears the strip. (See view to the left in Fig. 2.) The operator can push the gage into the path of the strip when it is to be in the operating position. (See view to right in Fig. 2.) If the preliminary gage should be inconvenient

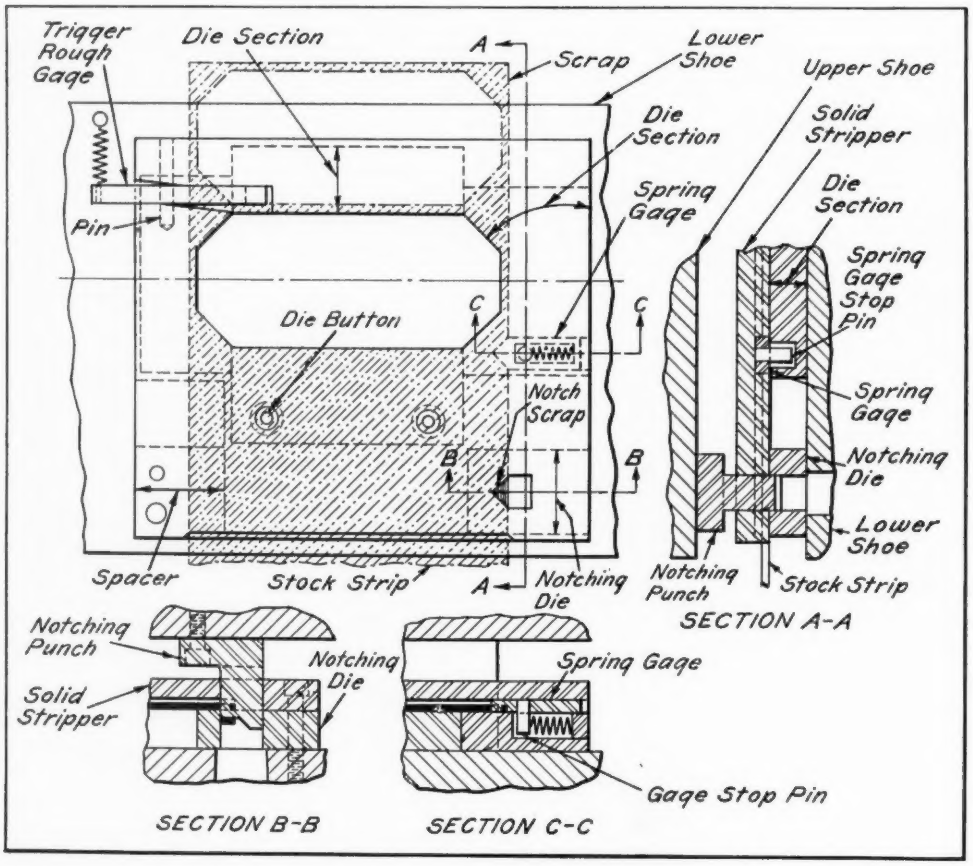


Fig. 3. Finish-gaging by a Notch in the Side of the Stock Strip

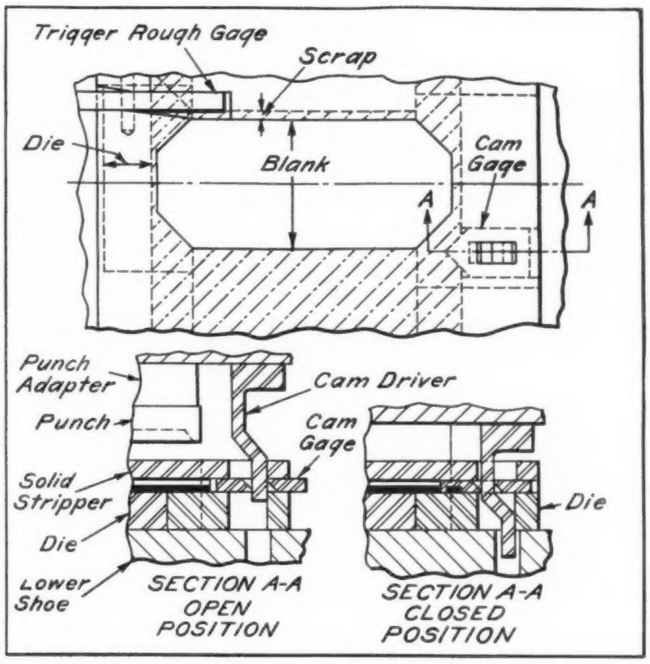


Fig. 4. Holding the Notch Gage in an Out Position by Means of a Cam Driver

for the operator, a pivoted lever may be attached to the gage, extending to a more accessible location.

If the part does not require accuracy in pierced-hole location, the gaging of the stock strip is the same as that of a drop-through blanking die—on one side only, and at the end. However, when the location of the pierced holes must be accurate, part or all of the ordinary types of gages are used for rough-gaging only, and additional gaging is required.

The reason for adding some type of finish-gaging is that a progressive type blanking and piercing die has the disadvantage, compared with a compound type, of being less accurate in producing the required location of the pierced holes in relation to the blank edge. In a compound die, there cannot be any variation, since the blanking and piercing occur in the same stage. However, in a progressive die, there can be a variation if the operator does not keep the stock strip against both the side and the end gages at every die stroke. The last blank is particularly likely to be inaccurate, since the stock strip is guided at the left side for only a short distance. In order to insure greater gaging accuracy, either pilot-pins, gaging notches, or spring gages on the right-hand side of the stock strip may be used.

Types of Gages to Insure Accuracy

The most common method is to insert pilot-pins in the blanking punch. These pins have tapered ends which enter the holes in the stock strip that were pierced in a previous stage. If the stock strip is not in exactly the correct location, the gage pins will move it into the correct position.

Two gage pins are usually sufficient for this purpose, unless they are very small, when more gage pins may be required to give added strength. If there are no holes in the blank suitable for gaging, it may be that holes can be added for the specific purpose of providing for gaging. The successful use of pilot-pins depends on their strength in comparison with the weight of the stock strip, the speed of the press, the distance between the pilot-pins, and their diameter. This type of finish-gaging is complete in that the stock strip is gaged in all directions.

A second method of finish-gaging is to cut a notch in that side of the stock strip which is opposite the side with the gages. The notch must be in the side scrap either between the blanks or opposite a blank, provided this does not waste stock.

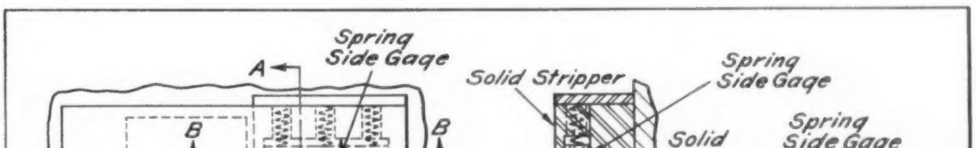


Fig. 5. Use of Spring Side Gage for Finish-gaging

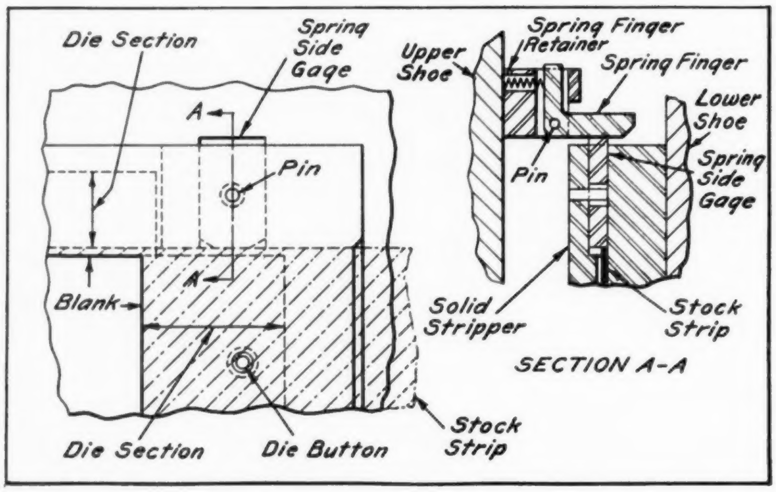


Fig. 6. Another Type of Spring Side Gage

This gaging system can only be used, therefore, for blanks with a shape that allows room in the side scrap for the addition of a notch. The notch is cut by adding a notching punch in the piercing stage of the die, as indicated in Fig. 3. The notch is tapered and extends inward from the edge of the stock strip.

A spring gage is added in the proper location relative to the blanking stage for entering the notch. As the operator pushes the stock strip to feed it to the next position, the spring gage is forced out of the old notch by the taper on the sides of the notch, and snaps into the new notch when the stock strip has been fed the required distance. A solid stripper and a trigger end gage for rough-gaging could be used with this type of spring notch gage for finish-gaging. With a solid stripper, it is not necessary to lift the stock strip over the end gage and thereby disengage it from the spring notch gage.

In order to make the operator's work easier, the notch gage can be made to clear the stock strip automatically when the die is in the open position. With such a construction, the operator can feed the stock strip without the resistance of the spring operating the notch gage. The operator feeds the stock against an approximate end gage while the die is in the open position; and in that position, a cam driver, as indicated in Fig. 4, fastened to the punch-shoe, holds the notch gage in an "out" position, clear of the stock strip. On the down stroke of the punch, the cam driver gradually causes the notch gage to enter the notch in the stock strip, which moves the strip to the correct position. On the up stroke of the punch, the cam driver moves the notch gage outward clear of the stock strip. This type of finish-gaging also completely gages the stock strip, sidewise and endwise.

A third method of finish-gaging is to use a spring side gage on the right-hand side of the stock strip, thus forcing it against the solid left side gages, as shown in Fig. 5. This corrects the inaccuracy of side gaging, since the operator is no longer depended on to keep the stock strip in contact with the left side gages. However, it does not correct inaccuracy of end gaging, since the operator can still fail to keep the stock strip in contact with the end gage. The spring side gage is operated by light spring pressure. Its inward travel should be limited by a stop, allowing 1/8 inch of travel beyond its theoretical operating position.

A spring side gage makes it more difficult to feed the stock strip on account of the friction; but this friction can be eliminated by relieving the spring pressure with cam action when the die is in an open or partly open position, as shown in the bottom views of Fig. 5. It is not practicable to operate the spring gage inward by cam-driver action without the use of springs, since a cam driver has a positive travel and could not adjust itself to variations in the width of the stock strip. Instead, the spring gage is forced inward by spring action, and the driver is used only to move the gage back during the up stroke, so as to leave the stock strip free

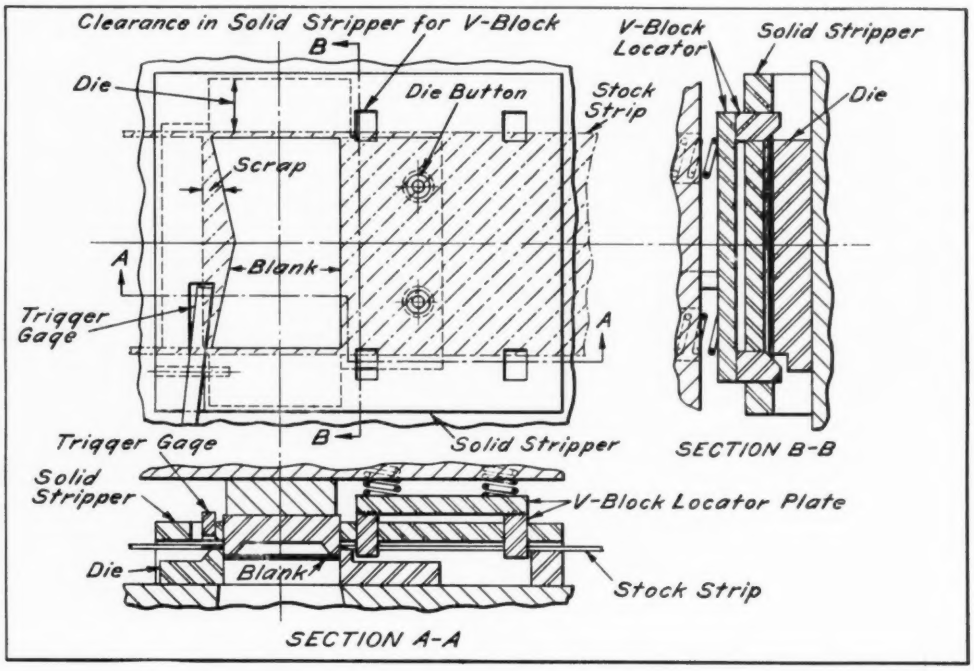


Fig. 7. Finish-gaging by Means of a Spring-operated V-block

from any pressure which would interfere with feeding. The length of the driver is such that it never leaves the gage.

Another type of spring side gage which clears the stock strip when the die is open, or partly open, is shown in Fig. 6. The side gage on the right-hand side of the stock strip has no spring action of its own, but derives spring action from a finger which is fastened to the upper shoe. This spring finger is a pivoted crank operated by a spring which exerts a sidewise pressure on the side gage. Thus any variation in the stock strip width is taken up by the spring action. In the open die position, the spring finger travels up with the upper shoe and the spring side gage exerts no pressure on the stock strip.

A fourth method of finish-gaging is by means of a spring-operated V-block, as shown in Fig. 7. The V-block is fastened to the upper shoe by retainer screws and is operated by springs. When the die is open, the V-block is in the "up" position, leaving the stock strip free for easy feeding. On the down stroke, the V-block centralizes the stock, regardless of variations in its width. The V-block must be guided sidewise to take the side thrusts resulting from the moving of the stock strip. This device may be constructed of a plate with two pairs of V-blocks attached. This spring V-block corrects side gaging inaccuracies, but does not remedy failure of the operator to push the stock strip against an end gage. The heavier and longer the stock strip, the greater the difficulty of the spring V-block in accomplishing its function.

* * *

Westinghouse New Welding School

A new welding school has been equipped at the East Pittsburgh plant of the Westinghouse Electric & Mfg. Co. for thoroughly training men in the latest practices of arc welding. The school is provided with modern equipment for direct-current, alternating-current, and automatic welding. Each student is assigned to an individual machine which he uses throughout the course. Two instructors are on duty at all times. Lectures on the theory and on the care and operation of the machines are included in the course, which comprises 200 hours. With an average work week of 40 hours, the course is concluded in five weeks.

* * *

The value of watches and watch movements produced in the United States during 1937, according to the Census of Manufactures, was $60,410,000. It is of interest to note that in 1935 this figure was only $34,148,000.

National Metal Congress and Exposition in Detroit

The twentieth annual National Metal Exposition will be held in Detroit, Mich., October 17 to 21. More than 230 exhibitors have arranged for space up to the present time, including manufacturers of steel and non-ferrous metals, furnaces, welding equipment, machine shop tools, and auxiliaries and eccessories of various kinds. Many manufacturers will exhibit for the first time. Of unusual interest this year will be the visit of some two hundred members of the Iron and Steel Institute and the Institute of Metals of Great Britain.

The American Society for Metals, the American Welding Society, and the Wire Association will hold meetings during the week of the exposition, and more than one hundred engineering papers will be presented. The program of the American Society for Metals alone includes fifty-three papers. One of the features of the meeting of this Society will be a two-day symposium on "Effects of Alloying Elements on the Hardenability of Medium and Low-Alloy Steels." There will also be five daily lectures on machineability, and three on pyrometry.

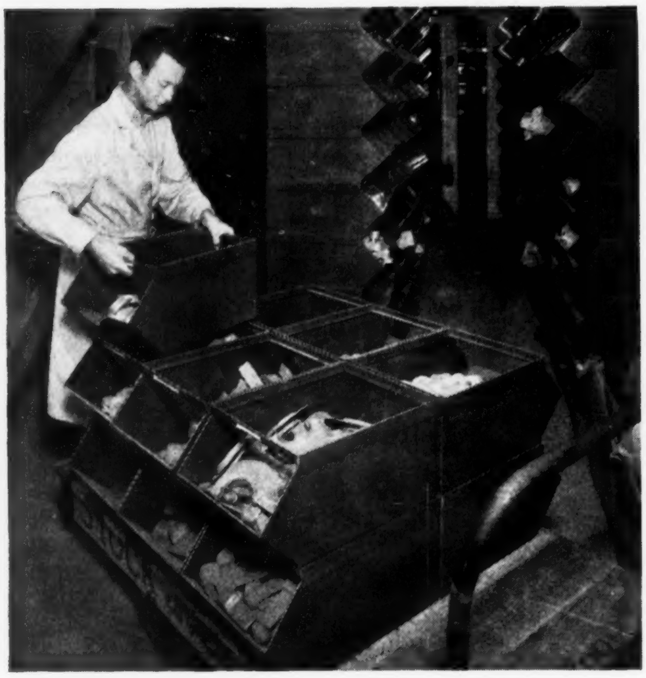
An annual feature of the American Society for Metals' program is the Edward De Mille Campbell Memorial Lecture, delivered each year by an outstanding authority in the metal field. This year's lecturer will be A. L. Boegehold, head of the metallurgical department of the General Motors Corporation, Research Laboratories Division.

* * *

At the well-known Leipzig Fair in Germany, large orders are regularly placed right at the Fair. The Fair management states that, according to reports made by exhibitors, orders were placed at the Spring Fair this year to a value of $217,000,000, of which export sales totalled $70,000,000.

A Section of the New Westinghouse Welding School

Flexible Stock-Room Equipment Meets Modern Manufacturing Requirements

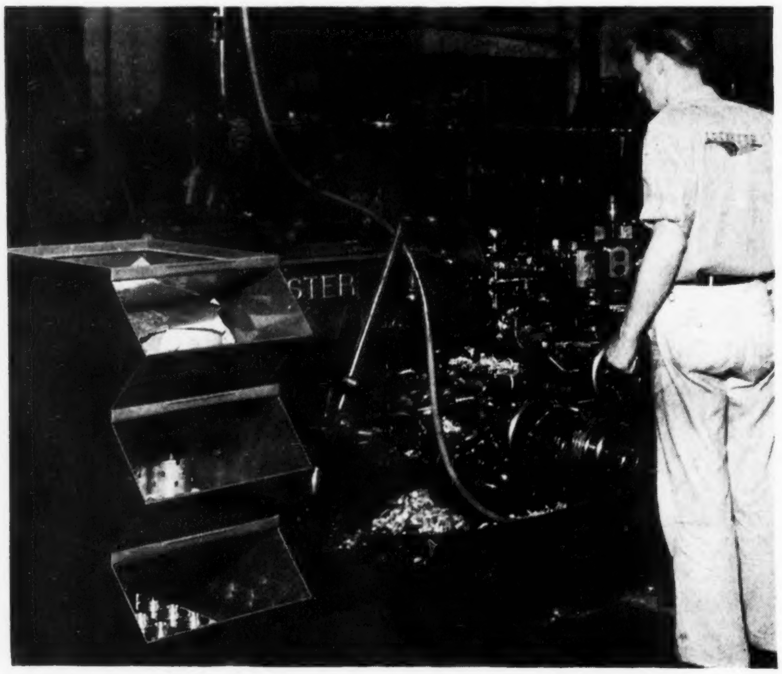


Stackbins can be Loaded on a Truck as Securely as though the Entire Group of Boxes Were a Single Unit

The Stackbins are Provided with a Grip for a Hook, so they can be Moved Conveniently around the Shop

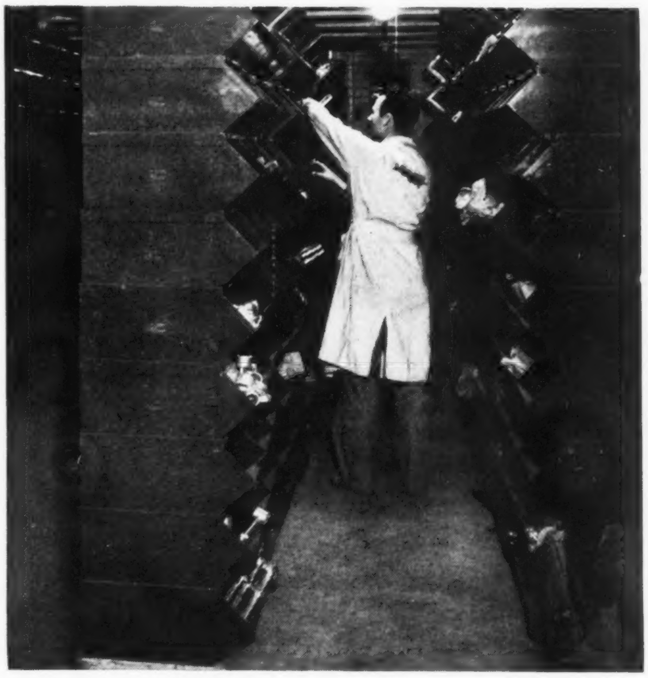
An unusual stock-room and novel handling methods have been installed at the plant of the Lockheed Aircraft Co. by the Stackbin Corporation, Providence, R. I. A new type of shop containers for loose parts and materials, known as "Stackbins," provides the basis for this storage system. When these boxes or Stackbins are not passing through the plant, they can be used and stacked with safety to any height in the stock-room, which is a bare room without shelves or fixtures of any kind. The Stackbins alone furnish the storage facilities of this room. They are of patented construction and nest together without the use of any auxiliary tools and equipment; yet they can be readily unstacked and moved or altered in lay-out to suit changing conditions whenever this is necessary.

As noted from the illustrations, these boxes have full-width open hopper fronts, providing visibility and accessibility. Thus the storage-room foreman can see at a glance the contents of several bins at a time and quickly find what he is looking for. He is saved the nuisance of pulling and pushing several drawers for an examination of the contents. There is also less danger of important stocks accidentally running low, or even running out entirely, without being noticed.



The Machine Operator Has All Parts that He Requires within Convenient Reach

When the entire contents of some Stackbin are wanted in the machine shop, several boxes are loaded on a shop truck as securely as if the entire group were a single unit, each box fitting into the rim of the one below. At the machines, the boxes stack up, providing vertical storage, economical of space. Because their ends provide access to the contents, they can be placed under the benches, around posts, or in blind corners, and thus leave bench and floor space clear for productive work.



Ample Storage Space is Provided in the Stock-room by the Use of Stackbins which can be Piled to Any Height

Furthermore, the operator may have the parts and materials he needs at arm's length. From where he stands at his machine, he can see and reach any item required. For short hauls from one machine to the next, the Stackbins can be pulled along the floor without lifting. A heavy angle-bar across the top provides a convenient place for gripping with a hook, and the smooth steel bottom will slide more easily than a wooden box.

Not the least advantage of this system of storage bins and tote boxes is that there is no need for calling in the carpenters when stock-room changes become necessary. On the contrary, the stock-room is as flexible as the convenience of the shop and the activity in the plant require. The Lockheed Aircraft Co. states that this new stock-room and handling system occupies only 20 per cent of the space previously used, and that only half of the time formerly required for transporting parts and materials is now so used.

* * *

Some politicians are so egotistical that they think that after they have publicly given utterance to a false statement, it becomes the truth.

Coming Meetings of the American Society of Tool Engineers

The American Society of Tool Engineers, 2567 W. Grand Blvd., Detroit, Mich., has announced that a national meeting of the Society will be held in Pittsburgh, Pa., October 14 and 15, with technical sessions and plant visits.

The annual meeting of the Society will be held at Detroit during the week of March 13 to 18, next spring, in conjunction with the second Machine and Tool Progress Exposition, which will be held in the Detroit Convention Hall. Frank Shuler, master mechanic of the Chrysler Highland Park plant and past-president of the Society, is general chairman of the spring meeting. Homer C. Bayliss, of the Motch & Merryweather Co., Detroit, Mich., is chairman of the program committee. Tentative applications for space at the exposition indicate that the floor space occupied by the show will be approximately double that of the exposition last spring.

* * *

The German Machinery Industry

According to *World Machinery News*, published by the Machinery Division of the Department of Commerce, the production of German machinery manufacturers is three times larger at present than it was in 1933. According to official estimates, the value of German machine production increased from somewhat over $600,000,000 in 1933 to about $1,800,000,000 in 1937, basing the dollar upon an exchange value of approximately 2 1/2 marks to one dollar. The number of workmen employed increased from 250,000 in 1933 to over 700,000 at the beginning of 1938.

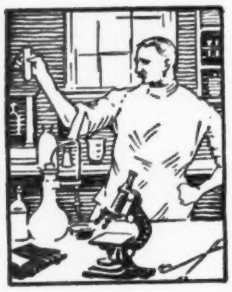
In 1933, about two-thirds of the German production of machinery was sold within the country, and slightly more than one-third was exported. In 1937, the machinery sold in the domestic market amounted to about 82 per cent, while slightly less than 18 per cent was exported. In view of the fact, however, that the production had increased threefold, this 18 per cent of present production represents an increase in exports well over 50 per cent, as compared with 1933.

* * *

A Remarkable Safety Record

What is believed to be one of the most unusual safety records in American industry is that of the maintenance department of the A C Spark Plug Division of the General Motors Corporation, Flint, Mich. There are several hundred men employed in this department. It has just passed the 1,000,000 man-hour mark without an injury of any kind. The number of safe hours work was still unbroken early in August and continued to increase. This safety record included a period of 597 working days.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Resistoflex Tubing for Use with Oils and Solvents

Resistoflex tubing in sizes up to and including 1/2 inch inside diameter is now being manufactured in this country by the Resistoflex Corporation, 370 Lexington Ave., New York City. This material is insoluble in gasoline, oil, ether, alcohol, etc. It is a flexible synthetic resin—basically polyvinyl alcohol—which has been manufactured for several years by foreign corporations. Its physical characteristics include extreme lightness (the weight being about one-half that of aluminum), great toughness and strength, good elasticity, and a high degree of flexibility.

The patented tubing has been used chiefly in fuel and brake lines, as well as in lubrication systems of automotive equipment, Diesel engines, and aircraft; in the conveying of solvents and oils in chemical and process industries; in hydraulic lines; and in fuel- and oil-handling equipment.......201

A New Alloy with Qualities that Approach Hardened Copper

A new alloy, known as "Cupaloy," which is said to be the closest approach yet made to hardened copper, has been developed by the research laboratories of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This alloy comes close to having the properties of pure copper, coupled with the strength of steel.

With this alloy, it has been found possible to make continuous welds that are unusually strong and gas-tight. It has been used in the welding of streamline trains, cooling systems for electric refrigerators, and for high-vacuum thermionic tubes for radio sets.

When used for welding tips, Cupaloy has proved to have a service life several times greater than that of pure copper, and from 50 to 200 per cent longer than that of other low-resistance alloys.

As an example of the hardness and strength of Cupaloy, the following experiment may be recorded: The research engineers placed a half-inch bar of Cupaloy against a bar of standard hot-rolled structural steel and squeezed the two together under a hydraulic press. There was an engraved insignia on the Cupaloy sample. This engraving made a deep indentation in the steel, but the Cupaloy sample was scarcely marked.

Cupaloy can be obtained with an elastic strength of 35,000 pounds per square inch and with remarkable heat and electrical conductivity. While pure copper loses much of its work hardness after a few hours' exposure to temperatures of 400 degrees F., Cupaloy will withstand temperatures of 750 degrees F. with relatively little permanent softening. Its rate of wear under the most severe tests was only 40 per cent of that of hard-drawn copper. Because of its high strength and hardness, exceptional wear resistance, heat endurance, and high electrical and heat conductivity, Cupaloy has been used for the current collecting surfaces of a homopolar generator rotor required to carry currents of 150,000 amperes under an unusually high centrifugal stress. 202

Dyn-el, a High-Strength Flat-Rolled Steel with Unusual Properties

A new high-strength, flat-rolled steel with unusual capacity to resist fatigue, impact, and corrosion has been developed by the Alan Wood Steel Co., Conshohocken, Pa. In addition to having unusual physical properties, an important feature of the new steel is that it can be produced at low cost.

This steel permits safe working loads of 25,000 pounds per square inch. The elastic limit is 58,000 pounds per square inch, and the tensile strength, 72,000 pounds per square inch. The elongation in 2 inches is 28 per cent, and the reduction of area, 60 per cent.

The general applications for which Dyn-el is suitable include railroad rolling stock, permitting reduction in dead load at no decrease in strength or service life; trucks, buses, and other automotive equipment, to obtain reduced weight with increased strength; and stationary structures, to obtain increased strength, longer life, and resistance to corrosion. The material is available in thicknesses from 18 U.S.S. gage (0.0478 inch) to 3/8 inch..203

To obtain additional information about materials described on this page, see lower part of page 44.

Molybdenum Valve Castings for Low Temperatures

Industrial processes that require the operation of equipment at very low temperatures are becoming more and more common. Certain processes in oil refining are well known examples, but similar conditions are constantly arising in other industries. As a result, materials that will be dependable at low temperatures are important.

The selection of wrought steel for parts subjected to low temperatures is not a difficult problem, but there are a great many parts for low-temperature service that can advantageously be made from cast steel. Valve bodies are an example of this. The comparatively low-temperature impact properties of wrought steel have been thoroughly investigated, but it has been difficult to obtain a cast steel that would meet the impact requirements at very low temperatures.

The Merco Nordstrom Valve Co. of Oakland, Calif., has met this difficulty by developing a nickel-molybdenum cast steel that fully meets the low-temperature specifications adopted so far. This steel is used for valve bodies of different types and sizes working at various temperatures and pressures. In one plant, these valves are used in the manufacture of ethyl chloride, where temperatures as low as — 150 degrees F. are encountered. These valves are equally suitable for handling liquid air, brine, or for use in de-waxing plants. Generally speaking, they can be used at any temperatures down to — 150 degrees F., where a minimum impact strength of 15 foot-pounds Charpy is specified. The valves are designed to operate at pressures up to 600 pounds per square inch.

The steel from which the valve bodies are cast has a composition approximately as follows: Carbon, 0.08 per cent; manganese, 0.29 per cent; silicon, 0.12 per cent; phosphorus, 0.015 per cent; sulphur, 0.018 per cent; nickel, 4 per cent; vanadium, 0.16 per cent; and molybdenum, 0.5 per cent.

After being cast, the valve bodies are subjected to a heat-treatment that consists of normalizing at from 1800 to 1850 degrees F., quenching in oil from 1500 to 1550 degrees F., and drawing at approximately 1200 degrees F. The castings are held at the normalizing, quenching, and drawing temperatures for one hour per inch of section.

The physical properties of typical samples are as follows: Tensile strength, 107,000 pounds per square inch; yield point, 88,000 pounds per square inch; elongation in 2 inches, 22.5 per cent; reduction in area, 61 per cent; and Charpy impact test at — 150 degrees F., 20 foot-pounds.

This steel is entirely practical from a foundry standpoint. Valve bodies weighing up to 500 pounds have been cast with no apparent limitations as to the thickness of sections. The steel is easily machined, either in the normalized condition or after heat-treatment. This is an important feature, since considerable machining to very close tolerances is required on the valve bodies..........204

Seamless Non-Separable Laminated Rubber Lining for Tanks

A new type of Multi-ply seamless rubber lining for plating and chemical tanks has been developed by Collord, Inc., Detroit, Mich. In this new method of lining tanks with rubber, the liquid rubber is applied in laminations to the metal to be coated until the desired thickness is obtained. These several coats or plies coalesce during the vulcanizing process into a single and inseparable sheet, bonded or almost "welded" to the walls of the tank. The result is a continuous seamless lap-free and unbroken lining. 205

The Use of Aluminum Die-castings for the Base, Platters, and Indicator Housing of this Toledo Scale Made it Possible to Reduce the Weight of the Scale from the 50 Pounds of the Former Model to 13 Pounds. An Interesting Feature of this Scale is that it is Provided with what in the Machine Shop would be Called a "Vernier Scale," Making Extremely Accurate Determinations of Weight Possible

To obtain additional information about materials described on this page, see lower part of page 44.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 43 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the September Number of MACHINERY

Lathe Attachment

LODGE & SHIPLEY MACHINE TOOL Co., Cincinnati, Ohio. Publication entitled "Eliminate Cut and Try—Substitute Direct Reading of Lengths and Diameters," illustrating and describing a new attachment for the direct-reading of diameters being turned and of carriage travel. 1

Bonderizing and Rust Prevention

OAKITE PRODUCTS, INC., 26 Thames St., New York City. Recent issue of *Oakite News Service* describes how the only bonderizing plant on the West Coast devoted to processing steel windows effectively rustproofs casement, monumental, and industrial steel windows. 2

Precision Measuring Tools

GEORGE SCHERR Co., 124 Lafayette St., New York City. Folder discussing precision measurements and various applications of Mauser tools. Supplementary folder listing fourteen benefits that both employers and mechanics derive by the use of vernier calipers in shop and plant. 3

Grinding Machines

LANDIS TOOL Co., Waynesboro, Pa. Catalogue C-38, illustrating and describing the Landis 10-, 14-, and 16-inch Type D plain hydraulic grinders. In addition to a detailed description of these machines, information is given on many typical operations. 4

Flame Cutting

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Bulletin illustrating and describing the Ryerson flame-cutting service, showing the wide range of products that can be cut from rolled-steel plates by flame-cutting methods. 5

Steel

KLOSTER STEEL CORPORATION, 224-228 N. Justine St., Chicago, Ill. Four bulletins on Pure-ore D-C-66 hot-work steel; "Hi-Run" high-chrome, high-carbon steel; D-C-33 hot-work steel; and oil-hardening "Swed-oil" non-shrinking steel, respectively. 6

Indicating and Controlling Instruments

C. J. TAGLIABUE MFG. Co., Park and Nostrand Aves., Brooklyn, N. Y. Catalogue 1060-D, illustrating and describing a new line of Tag indicating, recording, and controlling instruments for temperature and pressure. 7

Carboloy Tool Grinders

CARBOLOY COMPANY, INC., 2987 E. Jefferson Ave., Detroit, Mich. Bulletin GT-104, descriptive of the No. 41 bench type Carboloy tool grinder, designed for sharpening carbide-tipped tools with diamond wheels or lapping disks. 8

Contour Sawing and Filing Machines

CONTINENTAL MACHINE SPECIALTIES, INC., 1301-7 Washington Ave., S., Minneapolis, Minn. Folder on the Doall band sawing, filing, and polishing machine, including information on filing and sawing speeds. 9

Forgings and Castings

FORGING & CASTING CORPORATION, Ferndale, Detroit, Mich. Catalogue entitled "F C C Products and Services," covering forgings, composite die sections, Nitri-cast-iron, tool steel cast to shape, air-hardening welding rod, etc. 10

Electric Control Switch

KNEISLEY ELECTRIC Co., 16 S. St. Clair St., Toledo, Ohio. Circular illustrating and describing a new 30-ampere, rotary type, fully enclosed, current control switch with many improved features. 11

Hydraulic Universal Grinding Machines

NORTON Co., Worcester, Mass. Bulletin 1668, descriptive of Norton 12-, 14- and 16-inch multi-purpose hydraulic universal grinding machines. 12

Cutter Grinders

R. K. LE BLOND MACHINE TOOL Co., Cincinnati, Ohio. Circular containing construction details and specifications covering the Le Blond No. 3 cutter grinder with universal wheel-head. 13

Carbide Tool Grinders

EX-CELL-O CORPORATION, 1212 Oakman Blvd., Detroit, Mich. Catalogue CG-436, covering Ex-Cell-O carbide tool grinders, including complete specifications for the new bench type machine. 14

Round Belting

SUDBURY LABORATORY, South Sudbury, Mass. Leaflet on round composition belting that requires no metal fasteners and for which high frictional driving power and decreased belting costs are claimed. 15

Cold-Forged Socket Screws

HOLO-KROME SCREW CORPORATION, Hartford, Conn. Pocket-size catalogue covering Holo-Krome fibro-forged socket-head cap-screws, hollow set-screws, socket-head stripper bolts, and hollow pipe plugs. 16

Power Screwdrivers and Nut-Setters

INDEPENDENT PNEUMATIC TOOL Co., 600 W. Jackson Blvd., Chicago, Ill. Catalogue 70, describing bits and shanks for use with power screwdrivers and nut-setters. 17

Tube Shaping Tools

SAC TOOL MFG. Co., 1907 Washington Ave., St. Louis, Mo. Circular

illustrating and describing a combination tool that bends, cuts, flares, and swages copper, aluminum, or any soft-temper tube. 18

Allegheny Metal

ALLEGHENY STEEL Co., Brackenridge, Pa. Catalogue entitled "As the World Sees Allegheny Metal," illustrating many of the most recent installations of this metal in a variety of industries. 19

Compressors

INGERSOLL-RAND Co., 11 Broadway, New York City. Circular descriptive of the Model 425 semi-portable and portable engine-driven compressors for contracting and oil-field service. 20

Broaching Machines

AMERICAN BROACH & MACHINE Co., Ann Arbor, Mich. Circular descriptive of the American Type H horizontal hydraulic broaching machine for light internal broaching operations. 21

Bakelite Molding Materials

BAKELITE CORPORATION, 247 Park Ave., New York City. Circular containing data on Bakelite cellulose-acetate rainbow-hued materials for injection and compression molding. 22

Portable Electric Tools

SKILSAW, INC., 3310-20 Elston Ave., Chicago, Ill. Catalogue 40, containing 54 pages on portable electric tools for production, maintenance, and construction work. 23

Ball Bearings

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y. Bulletin 24, in a series on Ball Bearing Practices for the Shop Man, containing data on snap-ring bearings. 24

Hoists

HARNISCHFEGER CORPORATION, 4536 W. National Ave., Milwaukee, Wis. 26-page bulletin H-5, entitled "Handle It off the Floor," giving complete information on P & H hoists. 25

Blueprinting Machines

PARAGON-REVOLUTE CORPORATION, Rochester, N. Y. Catalogue describing the distinctive features of the Revolute 3H automatic blueprinting machine. 26

Portable Electric Tools

WODACK ELECTRIC TOOL CORPORATION, 4627 W. Huron St., Chicago, Ill. Circular descriptive of the Wodack "Do-All" electric hammer for use on stone, wood, and metal. 27

Carbide Tools and Blanks

MCKENNA METALS Co., Latrobe, Pa. Catalogue 2, describing the properties of Kennametal, and giving price lists covering tools and blanks made from this carbide alloy. 28

Jig Boring Machines

PRATT & WHITNEY, Division Niles-Bement-Pond Co., Hartford, Conn. Circular 412-1, illustrating and describing the Pratt & Whitney No. 2A high-speed precision jig boring machine. 29

Production Milling Machines

U. S. TOOL COMPANY, INC., Ampere, East Orange, N. J. Bulletin MM-2, descriptive of a new U. S. Multi-Miller, designed for high-speed accurate production milling. 30

Dust-Collecting Equipment

KIRK & BLUM MFG. Co., Cincinnati, Ohio. Booklet entitled "Dust Collecting Systems in Metal Industries," illustrating and describing a great number of installations. 31

Lighting Equipment

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Folder entitled "High Intensity Localized Diffused Lighting," illustrating and describing canopy lighting fixtures. 32

Hydraulic Couplings

HYDRAULIC COUPLING DIVISION OF THE AMERICAN BLOWER CORPORATION, 632 Fisher Bldg., Detroit, Mich. Booklet entitled "Traction Type Hydraulic Coupling." 33

Surface Finish Measurements

PHYSICISTS RESEARCH Co., 337 S. Main St., Ann Arbor, Mich. Circular

To Obtain Copies of New Trade Literature

listed on pages 42-44 (without charge or obligation) mark with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
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Name .... *Position or Title* ....

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Business Address ....

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illustrating and describing the Profilometer, an instrument for measuring surface roughness. 34

Steam Turbines

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Booklet B-2084-A, illustrating and describing Westinghouse Type C turbines for mechanical drive. 35

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BOSTON GEAR WORKS, INC., North Quincy, Mass. Circular 4-38, containing data on Oilite oil-cushion precision bronze bearings made by the Chrysler Corporation. 36

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GENESEE TOOL CO., Fenton, Mich. Folder illustrating tools made by the company, including milling cutters of all types, formed tools, saws, turning tools, and tool bits. 37

Welding Aluminum

ALUMINUM CO. OF AMERICA, Pittsburgh, Pa. 48-page booklet entitled "Welding Aluminum and Its Alloys," giving complete illustrated instructions on the subject. 38

Dust Control

W. W. SLY MFG. CO., 4700 Train Ave., Cleveland, Ohio. Bulletin No. 90, "Dust Control by Sly"; Bulletin No. 91, "The Improved Centri-Merge Wet Dust Collector." 39

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GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-2963, on automatic time switches for the control of alternating- or direct-current circuits. 40

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METAL & THERMIT CORPORATION, 120 Broadway, New York City. 32-page pamphlet illustrating and describing Murex heavy-coated welding electrodes. 41

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BARBER-COLMAN CO., Rockford, Ill. Catalogue illustrating and describing a new combination reamer, hob, and cutter sharpening machine. 42

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SPEEDWAY MFG. CO., Cicero, Ill. Folder entitled "Speedway No. 250 Kit," illustrating and describing portable electric drills and grinders. 43

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WROUGHT WASHER MFG. CO., 2100 S. Bay St., Milwaukee, Wis. Stock list 55-B of standard and special washers. 45

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LINCOLN ELECTRIC CO., Cleveland, Ohio. Application Sheet No. 61, Series 2, on economics of welded design and practical applications. 46

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NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 59-D, covering Niagara No. 101 bench presses. 47

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INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Publication entitled "Nickel—a Versatile Automotive Metal." 48

Steel Castings

NATIONAL-ERIE CORPORATION, Erie, Pa. Bulletin No. 5 entitled "Steel Castings—Rough, Finished, or Heat-Treated as Specified." 49

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BODINE ELECTRIC CO., 2254 W. Ohio St., Chicago, Ill. Bulletin entitled "Built-In Worm-Gear Speed Reducer Motors." 50

Arc Welders

HOBART BROS., Troy, Ohio. Catalogue on the advanced Hobart multi-range arc welder. 50-A

Socket Screws

BRISTOL CO., Waterbury, Conn. Bulletin 836, on socket set-screws and cap-screws. 50-B

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on page 45 and following is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on page 45 and following—or write directly to the manufacturer mentioning machine as described in September MACHINERY.

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To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 40-41 mark with X in the squares below, the identifying number found at end of each description on pages 40-41—or write directly to the manufacturer, mentioning name of material as described in September MACHINERY.

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Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

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Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Heald Internal and Face Grinding Machine

A new Gage-Matic machine designed to grind the internal bore of a part in a fully automatic cycle and then at the same setting, without rechucking, grind the adjacent external face in a plunge cut, using a separate cup-wheel, has just been brought out by the Heald Machine Co., Worcester, Mass. In this machine, the face is ground square with the bore to extremely close limits, the bore itself being held to very close limits by the Gage-Matic method of automatic sizing with solid plug gages. The operation is easy, one operator being able to care for two machines.

Basically, this new machine, designated the No. 72A3 T base internal and face grinding machine, is similar to the standard Gage-Matic, with the difference that two separate wheel-heads for both hole and face grinding are mounted on the wheel-head cross-slide, the work-head being mounted on a hydraulic cross-slide at the end of the machine in order to permit indexing the work from the hole-grinding to the face-grinding positions. A T-section at the left end of the base supports the work-head cross-slide.

The wheel-head at the rear of the cross-slide is used for hole grinding, and the one at the front, which carries a large cup-wheel, is employed for face grinding. Both wheel-heads are driven by a single motor from an idler pulley which drives the front head through multiple V-belts and the rear head by a flat belt. The heads are, of course, driven at different speeds to provide the most efficient cutting action on each surface.

The work-head is mounted on a hydraulic cross-slide on the T-section of the base. Movement of the slide is controlled by a hand-operated valve at the front of the machine. For grinding the hole, the cross-slide is indexed to the rear, and for face grinding, it is indexed to the front. The position of the cross-slide is controlled by accurate

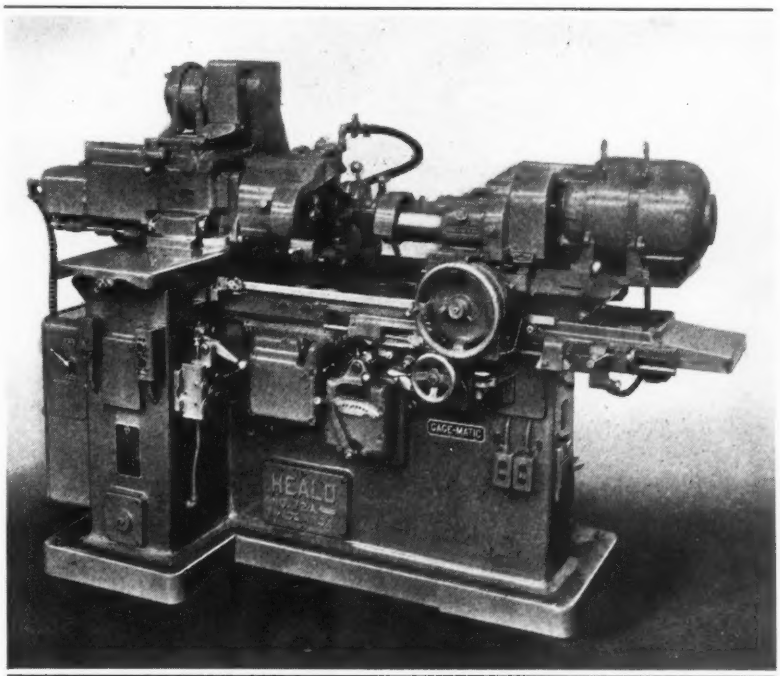


Fig. 1. Heald Internal and Face Grinding Machine with Gage-Matic Equipment

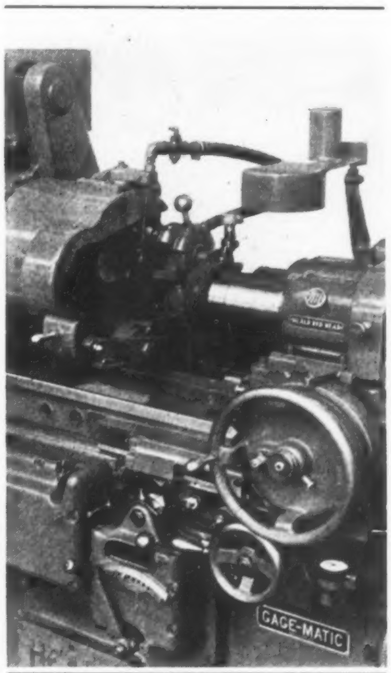


Fig. 2. Close-up View of Set-up on Machine Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 44.

stops. As the cross-slide indexes from one position to the other, hydraulic valves automatically slow down the rate of the cross-slide travel, in order to cushion the stops against shock. Safety limit switches prevent the table from running forward unless the cross-slide is either in the extreme front or rear position. Also, the cross-slide cannot be indexed until the table has nearly reached a rest position.

Face grinding is accomplished by a handwheel cam type facing attachment mounted on the front of the machine. This unit provides a very smooth facing feed. A dial indicator shows the exact amount of stock to be removed. The facing dog is equipped with a micrometer adjustment which compensates for wheel wear and for truing. The periphery of the internal grinding wheel is trued automatically during the Gage-Matic cycle by the standard diamond truing unit. For truing the face of the large cup-wheel, a special hand-operated diamond and intermediate truing dog are provided. 51

Lapointe Pull-Down and Surface Broaching Machines

The Lapointe Machine Tool Co., Hudson, Mass., announces improvements in its lines of vertical hydraulic pull-down and surface broaching machines. The pull-down machine shown in Fig. 1 has a 50-ton pulling capacity and a maximum stroke of 52 inches, but various combinations of tonnage and strokes are available, the smallest being a 5-ton, 36-inch stroke machine.

The particular machine shown in Fig. 1 is used for broaching splined holes in airplane propeller hubs on which the tolerances are extremely close. The new automatic key type puller used on this machine will handle all sizes of broaches having shanks designed for use with the standard horizontal broaching machines.

An outstanding feature of this machine is the use of electrical and hydraulic devices to insure proper operation and to prevent damage to the machine or tool equipment. Solenoid-operated valves, a photo-electric cell, and limit switches are employed effectively in this safety equipment. Four pilot lights, two on each side of the nameplate at the front of the machine, show when the broach-lifter is starting downward, when the main ram is starting downward on the broaching stroke, when the main ram is starting upward on the return stroke, and when the broach-lifter is starting upward to complete the cycle. Failure of the lights indicates that the machine is not in proper condition for operation, and it is a simple matter to trace the circuits to determine the cause.

The improved surface broaching machine shown in Fig. 2, which has a capacity of 5 tons and a maximum ram travel of 36 inches, is the latest single-ram type machine brought out by this company. Machines of the same type are made in various combinations of stroke and ton-

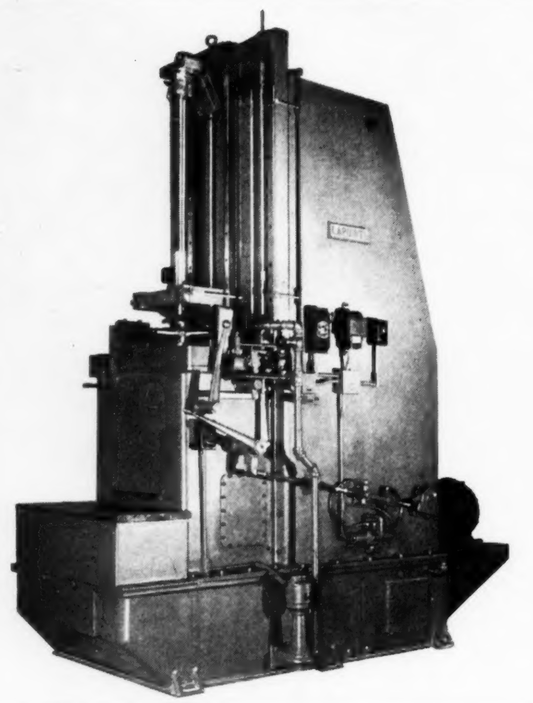


Fig. 1. Lapointe 50-ton Pulldown Broaching Machine

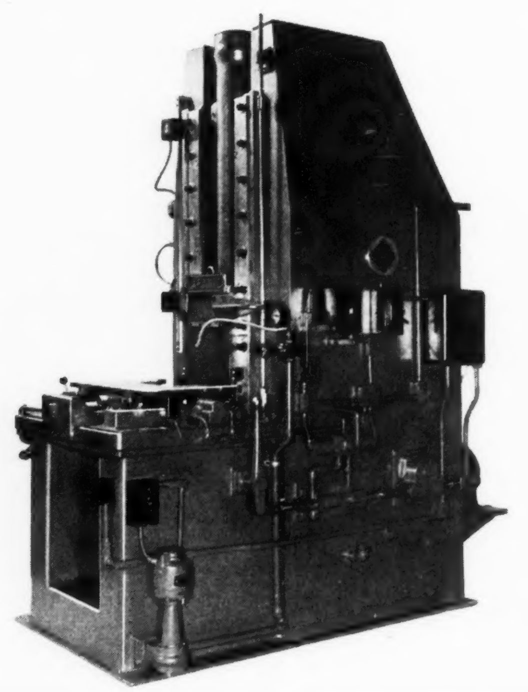


Fig. 2. Lapointe Single-ram Surface Broaching Machine

To obtain additional information on equipment described on this page, see lower part of page 44.

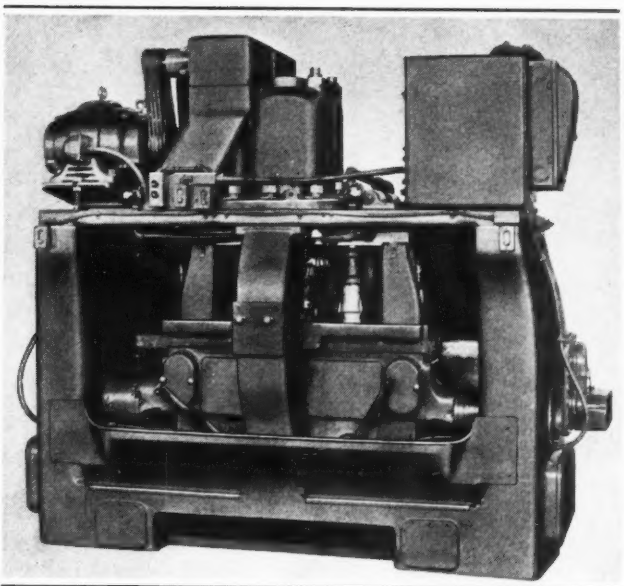


Fig. 1. "Rotomill," Brought out by the National Broach & Machine Co.

Fig. 2. Machining Transmission Counter Gear on Machine Shown in Fig. 1

nage capacities. Suitable work-holding fixtures are attached to the hydraulically actuated "in-and-out" slide mounted on the bolster. One of the new features of this machine is the opening in the front of the base, which provides ample room for the operator's feet and legs while he is sitting comfortably on a stool close to the machine.

A manual control is provided for convenience in setting up tools and making necessary adjustments. There is also an electrical control for operating the machine on production work, the push-button station being located at the right-hand side of the bolster. Limit switches, cam-operated by the main slide and by the fixture slide, are connected in series to insure having all motions follow each other in proper sequence during the operating cycle.

An adjustable speed control provides an infinite rate of speeds for the main slide in both directions. When the machine is idle with the motor running, the main pump does not discharge in either direction. An outstanding advantage of the control system employed on this machine is the elimination of shock when the direction of travel of the main slide is reversed.......................52

"Rotomill" for Machining Cylindrical, Conical, and Flanged Work

A production machine designated the "Rotomill," in which milling cutters are employed to machine work of the kind commonly finished by turning in a lathe, has been brought out by the National Broach & Machine Co., Detroit, Mich. This machine has been designed to combine economy, convenience of operation, and flexibility in the machining of both small-lot and high-production work.

Any type of cylindrical, conical, or flanged work can be machined on the Rotomill, including such work as gear blanks, shafts, steering knuckles, and artillery shells. Practically any turning operation normally performed on a lathe or screw machine can be handled on this machine. Precision, speed, and economy are advantages claimed for the machine. In normal production, parts are held to a limit of 0.004 inch on all dimensions.

The Rotomill, as shown in Fig. 1, has a reciprocating table which carries two vertical work-spindles *A* and *B*, Fig. 2. There are two vertical cutter-spindles *C* and *D*, one located at each side of the table. In operation, the table moves rapidly from the loading position toward the cutter-spindles. The rate of table travel is automatically retarded as the cutting begins. As soon as the work-spindle has reached a point between the cutter-spindle centers, it starts to rotate and continues rotating through either 185 or 370 degrees, depending on the nature of the operation. When the rotation limit has been reached, the table returns rapidly to its initial position, where the work is unloaded.

As there are two work-spindles, it is apparent that one is moving away from the cutters while the one at the opposite end of the table is moving up to the cutters. The rapid advance to the cutting position requires only from 5 to 7 seconds. The rest of the cycle—approximately 80 per cent in the majority of cases—is free for loading and unloading without interrupting continuous cutting. This usually gives more than enough time for loading and unloading. It has been found that one operator can conveniently handle two machines.

The cutters are rotated normally at speeds of approximately 150 surface feet per minute. The work-spindles are operated slow-

To obtain additional information on equipment described on this page, see lower part of page 44.

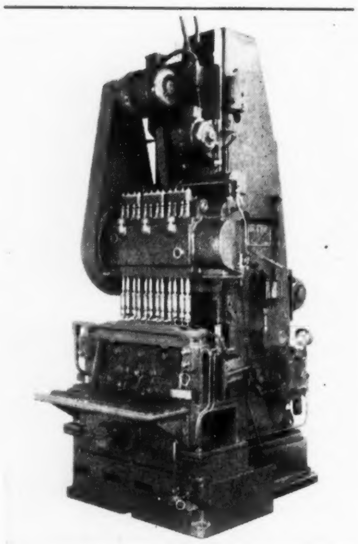
ly enough to give the proper time for cutting. When cutters are kept in sets and mounted on solid keyed arbors, the changing of cutters is merely a matter of setting the arbor. With this arrangement, the change can be made and operation resumed in practically twenty minutes.

The cutter life varies, of course, with the nature of the work. On average work, it is usually possible to obtain from 1500 to 2000 finished pieces per grind using the 370-degree Roto-mill cycle. On the 185-degree cycle, this number runs from 3000 to 4000 pieces. 53

Moline Valve Chamfering and Counterboring Machine

A drilling machine equipped with a hydraulic feed, which is especially designed for chamfering valve seats and finish-counterboring exhaust valve insert holes in automotive cylinder blocks, is a recent development of the Moline Tool Co., Moline, Ill. This machine is equipped with an air-operated holding fixture which is loaded from the front of the machine. An air cylinder which operates a toggle and wedge lock mechanism clamps the block securely against the stationary top plate of the fixture. This method of clamping is necessary, since the depth of the exhaust valve counterbore must be gaged from the top.

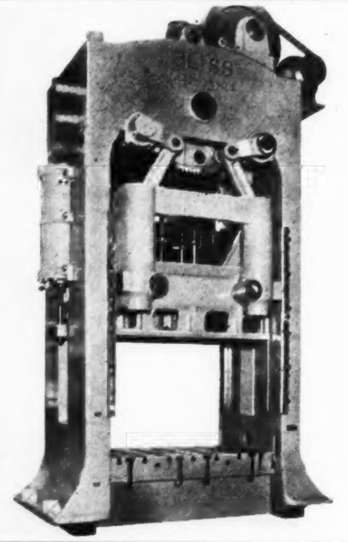
In operation, the hydraulic pump feeds the entire moving carriage down to a predetermined positive stop. At this point, the hydraulic pressure holds the carriage stationary against the stop and a small motor mounted directly under the main drive motor rotates three cams which feed the tools.



Moline Drilling Machine Equipped for Chamfering Valve Seats

The twelve spindles, which are rotated by the standard Moline spiral drive, are arranged in three groups of four each, each group being actuated by one cam. The cams are set so that all three groups of tools do not start to cut simultaneously, but are fed in and brought back with a slight time lag between similar portions of the cutting operations. The cams are so designed that each group of spindles is fed down at an initial rate of 0.013 inch per revolution, followed by feeding rates of 0.003, 0.008, and 0.004 inch, and ending with a dwell. When the cams have finished their movement and the tools have been withdrawn, the small motor is stopped automatically and the carriage, which moves on heavy double-vee guides, is returned hydraulically to the starting position.

Push-button control of the spindle driving motor and hydraulic pump motor is provided, the push-button stations being located on the fixture. The machine is driven by three motors through V-belts. The main motor for driving the spindles is of five horsepower and operates at a speed of 1800 revolutions per minute. A small one-horsepower motor operating at a speed of 1800 revolutions per minute operates the cam feed, while a three-horsepower motor with a speed of 1800 revolutions per minute drives the hydraulic pump. The estimated production of this machine is from 75 to 80 cylinder blocks per hour. 54



Bliss Press Designed for Equal Distribution of Load Thrusts

Bliss Four-Point Single-Action Press

A lever type four-point press with opposed-motion rocker shafts has been brought out by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio, for blanking and shallow-forming work in automotive plants. The rocker shafts, running from front to back, impart an opposed motion to the levers by means of eccentrics. This motion draws the slide up and then pushes it down for the working portion of the stroke. With this arrangement, the thrusts are equally distributed over the gibs under all loading conditions. This construction also prevents any tendency of the slide to tilt while it is subjected to unbalanced loads. As the main outer links straddle the outer web of the crown, any possibility of bending the shaft is eliminated.

The linkage arrangement of this press provides a slight dwell at the bottom of the stroke, which is particularly desirable in drawing work. The dwell allows the metal to "set" when the punch is at the bottom of its stroke. The press shown in the illustration has a capacity of 250 tons at the end of the downward stroke. All gearing is contained inside the crown. Control of the machine, including inching, is

To obtain additional information on equipment described on this page, see lower part of page 44.

obtained by means of push-buttons. The clutch is of improved multiple-disk pneumatic type, and is incorporated in one unit with the brake. The drive is by means of V-belts.

The press operates at a speed of fifteen strokes per minute. The length of the stroke is 16 inches, and there is a 20-inch adjustment of the slide by means of a reversible electric motor. The die space is 48 inches. The bed is 50 inches front to back by 84 inches right to left. Incorporated in the bed is a self-contained externally guided pneumatic cushion which provides 22.6 tons blank-holding pressure with an air-line pressure of 100 pounds per square inch. Counterbalance cylinders, which compensate for the weight of the slide, are mounted in the uprights in order to give the press a clean-cut appearance. 55

LeBlond Universal Cutter Grinder

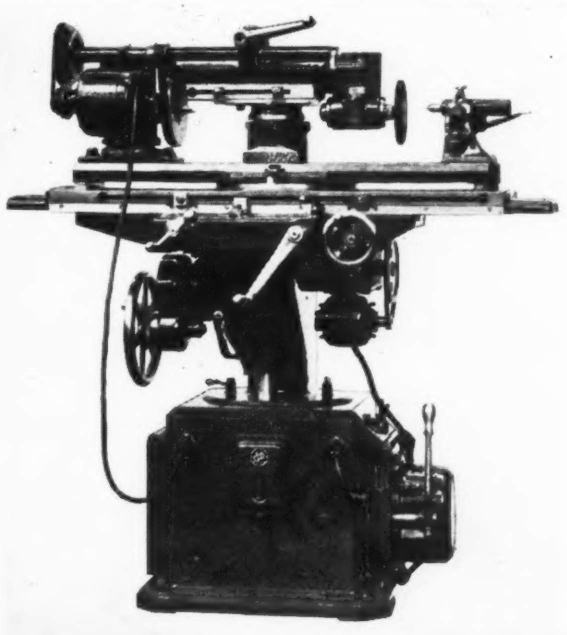
A new No. 3 universal cutter grinder, designed to give greater precision and efficiency and to handle a wider range of work, has just been introduced by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. The universal wheel-head of this machine has three independent and coordinated planes of full circular movement, which gives it exceptional versatility and flexibility. The variable-speed transmission provides a smooth vibrationless drive at the proper cutting speed for the grinding wheel used. There are four selective speeds to the spindle, namely, 3100, 4000, 5100, and 6500 revolutions per minute which cover a range sufficiently wide to meet practically all requirements.

The special construction of the universal table makes it possible to present the work to the grinding wheel at any position or angle desired. The feeding mechanism of advanced design operates smoothly and quickly. The work-head is driven by an independent motor with a variable-speed driving unit. The construction of the machine has been carefully planned with a view to insuring long life under rigorous use. 56

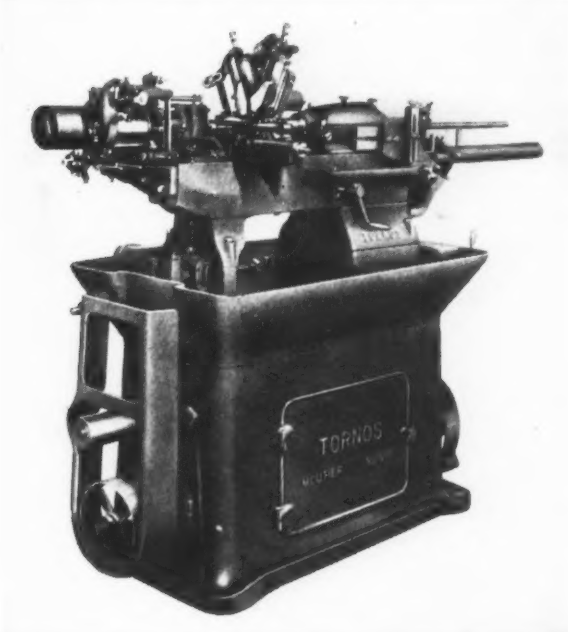
High-Speed Automatic Lathe

The George Scherr Co., Inc., 128 Lafayette St., New York City, has just introduced in this country a new model high-speed automatic lathe made by Usines Tornos, Moutier, Switzerland. This machine can be equipped with either four or five tools and with an accelerator for increasing the camshaft feed during idle periods. It is adapted for turning pinions of nickel or stainless steel, as well as for shaping or machining any intricate pieces, including small parts requiring drilling and tapping operations.

An outstanding feature of this machine is the headstock, which is designed for very high spindle speeds. The headstock also moves longitudinally, feeding the stock to the tools instead. The spindle can be fitted with either a single- or a double-cone collet. The longitudinal feeding movement of the headstock is produced by a mechanism termed the "Radiax," consisting of two special cross-levers which transform the radial stroke of one or more flat cams into the axial motion of the head-



Universal Cutter Grinder Designed by the R. K. Le Blond Machine Tool Co.



High-speed Automatic Lathe Placed on the Market by the George Scherr Co., Inc.

To obtain additional information on equipment described on this page, see lower part of page 44.

stock. This mechanism makes it possible to turn all parts of average length by feeding movements obtained from flat cams.

The bar feed of the machine is fitted with an automatic stop which comes into operation at the end of the bar. A new bar is inserted into the feeding tube at the front of the machine. Chucking can be performed in any position of the headstock. Also, the chuck can be operated twice for each revolution of the camshaft, thus permitting very long pieces to be machined.

These automatic machines can be equipped with four or five tools, grouped radially as shown in the illustration, two of the tools being mounted on a rocking lever. Radial setting, axial setting, and centering are accomplished independently of each other. The combined drilling and thread cutting attachment located in front of the tools and a slotting device at the side particularly adapt the machine for manufacturing screws.

The machines have a single camshaft mounted on four bearings fixed to the back of the machine bed. The speed of the camshaft can be changed at will. The special construction of the worm and worm-wheel gearing through which the camshaft is driven permits easy adjustment for wear. The camshaft of the motor-driven model is driven directly by the spindle belt. This permits immediate and simultaneous stopping of the camshaft and main spindle in case of belt breakage, thus avoiding damage to the tools and machine. Automatic lathes similar to the one illustrated are made in eight sizes, taking stock ranging from 5/32 inch up to 1 3/16 inches in diameter. 57

Pratt & Whitney Measuring Machine with Electrolimit Pressure Tailstock

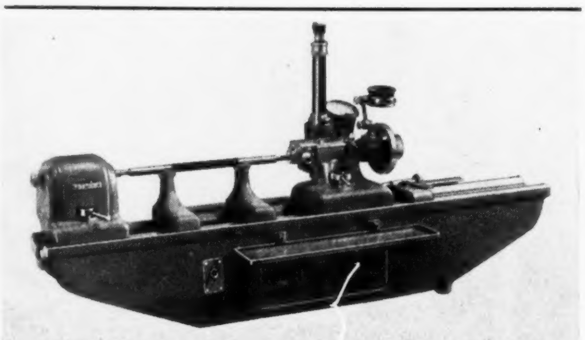
The standard measuring machine made by Pratt & Whitney, Division Niles-Bement-Pond Co., Hartford, Conn., is now being equipped with an Electrolimit pressure tailstock which operates on the same principle as the Electrolimit comparators, continuous gages, etc., made by this company. The Electrolimit unit contains a pair of balanced electric coils, having independent magnetic fields and a common armature, which floats between them. This armature consists of a steel bar mounted on a flat spring pivot at one end. It is in continuous contact with the measuring anvil, so that the least movement of the latter is transferred to the armature.

When a piece of work is brought against the measuring anvil, the armature is moved, unbalancing the magnetic fields of the two coils. This produces a relatively large unbalanced current for a very small movement. The result shows visibly in a corresponding movement of the micrometer needle. The operation of this machine is so simple that anyone can use it, no calculations being necessary other than the direct reading of the dials, which are graduated to 0.00001 inch.

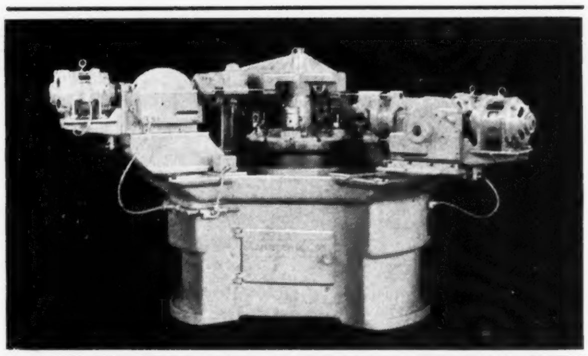
The measuring machine consists mainly of a master bar, a dividing screw, and the new Electrolimit pressure tailstock, all mounted on a rigid bed. The master bar is graduated at each inch interval, providing a permanently accurate setting. The graduations are extremely fine hair-lines, visible only through a microscope. The measuring head carries the microscope which has a hair-line graduation used to match the hair-line on the master bar. The precision measuring screw which subdivides the one-inch graduations is also included on the measuring head. The Electrolimit pressure tailstock eliminates most of the human element, making possible accurate measuring pressure from 1 to 2 1/2 pounds in increments of 8 ounces. 58

Machine for Milling Expansion Slots in Aluminum Alloy Pistons

Standard units were employed in the construction of a machine built recently by the Langelier Mfg. Co., Providence, R. I., for milling expansion slots in aluminum alloy pistons for the



Pratt & Whitney Measuring Machine which Reads Directly to 0.00001 Inch



Machine for Milling Slots in Aluminum Pistons, Built by the Langelier Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 44.

Truck and Coach Division of the General Motors Corporation. Four standard automatic, positive feed units are mounted on the circular base of this machine, as shown in the accompanying illustration. Three heads are equipped with auxiliary milling attachments, while the fourth unit is used for drilling a clearance hole for the cutter run-out.

The pistons are clamped with a locating pin through the wrist-pin hole, and indexed through the various working stations. The indexing unit in the base of the machine is controlled and interlocked electrically with the work-heads, so that all of the heads must be in the operating position before the dial can be moved. The base contains a tank from which coolant is delivered to the cutting tools by a motor-driven pump. The production averages 375 pieces an hour.........59

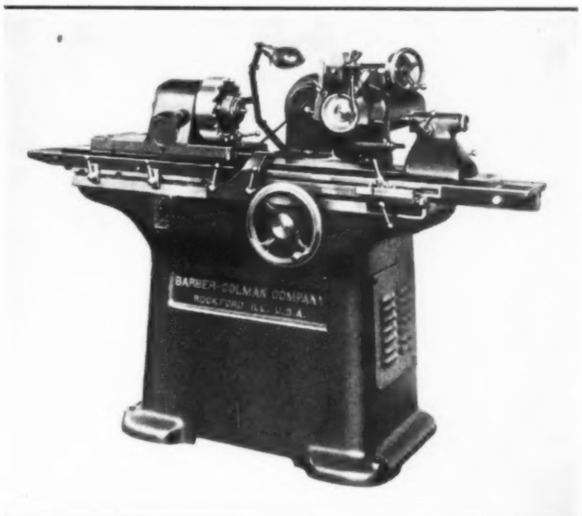


Fig. 1. Barber-Colman Combination Machine for Sharpening Reamers, Hobs, and Milling Cutters

Barber-Colman Combination Reamer, Hob, and Cutter Sharpening Machine

A combination sharpening machine designed to give positive mechanical control over the sharpening operations on reamers, hobs, and milling cutters has been brought out by the Barber-Colman Co., Rockford, Ill. Although many of the advantages afforded by the hob sharpening and the reamer sharpening machines made by this company are available in the new combination machine, it does not replace the former machines. The new machine does not have all the automatic devices incorporated in the two machines referred to, which are especially suitable for large-volume production, but it is particularly adapted for use in shops that do not have a sufficient volume of work to require the two types of automatic machines.

A wide variety of standard sharpening operations can be performed on the combination machine, and, in addition, several specialized grinding operations can be handled with greater speed and economy than formerly, yet with no sacrifice of accuracy. The forming or grinding of spiral leads, indexing, blade profile grinding, tooth-face grinding, cutter-clearance grinding on the diameter, grinding relief clearance, wheel-dressing and the grinding of radial faces on large-angle spirals, and various other operations are all under positive mechanical control. All mechanical movements of the machine can be positively duplicated to insure uniformity of work on any number of pieces.

In Fig. 2 is shown a set-up for grinding the tooth faces on a taper reamer. An extremely fine cutting edge is obtained by grinding both the diameter and the face of the reamer tooth. The small end of the reamer is raised with an adjustable offset ball-point tail-center until the edge of the blade on the upper surface

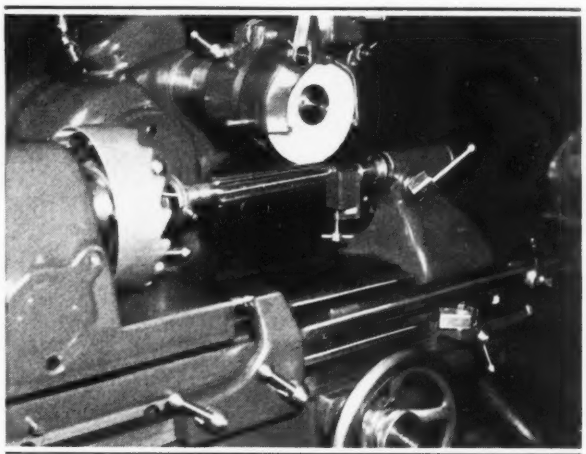


Fig. 2. Grinding Taper Reamer Tooth Faces on Barber-Colman Combination Sharpening Machine

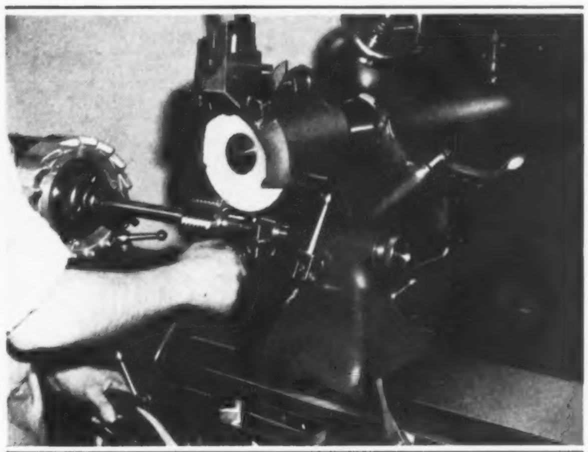


Fig. 3. Dressing Dish Wheel on Barber-Colman Machine Shown in Fig. 1 for Grinding Hob Teeth

To obtain additional information on equipment described on this page, see lower part of page 44.

of the reamer is parallel with the platen surface. A dish wheel is used for this operation.

The machine is equally well adapted for sharpening hobs. It affords accurate indexing, tangent bar control of the gash spiral, true radial faces on large-angle spiral hobs, and positive feed control. These are all important factors in maintaining an accurate tooth form in the hobbing process. The sharpening of hobs with large spiral angles is easily accomplished. The indexing and feeding operations for this kind of work are the same as for straight-gash hobs.

Milling cutters requiring accurate sharpening are readily handled, the speed and feed, as well as the indexing movements, being accurately controlled. Spiral-gash form-relieved cutters within the lead limits of the machine can be sharpened with equal facility. The teeth can be ground with hook or rake, as desired. The grinding-wheel spindle will take cup-wheels up to approximately 8 inches in diameter, and dish wheels up to about 6 inches in diameter.

In Fig. 3 is shown the method of dressing a dish wheel with the straight-line dresser. A knurled nut imparts straight-line radial motion to the diamond for dressing the back side of the wheel. The angle to which the wheel is dressed can be varied to suit the cross-section of the gash, an angle of approximately 25 degrees being common practice.

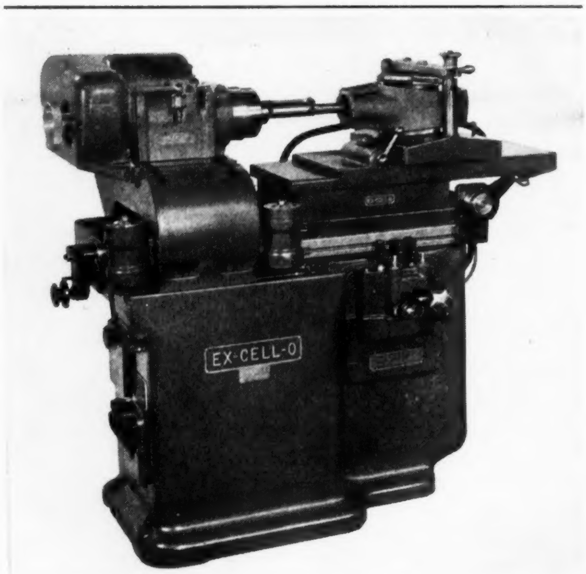
The maximum length of stroke for straight-gash grinding is 24 inches. The wheel can be set 30 degrees to the right or to the left for spiral work. The maximum length between centers is 33 inches. Any odd number of blades from one to fifteen, and any even number of blades from two to twenty can be ground. Grinding-wheel spindle speeds range up to 5000 revolutions per minute. A one-horsepower motor running at 3450 revolutions per minute operates the grinding wheel. A 1/4-horsepower pump is employed for the coolant system. The machine requires a floor space of 100 by 44 inches, and weighs 2550 pounds. 60

Ex-Cell-O Single-Spindle Boring Machine with Compound Table Movement

A single-spindle precision boring machine designed to bore two diameters simultaneously in a differential housing has been developed recently by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. The two diameters that form the seats of the pinion-shaft bearings of the differential housing are bored in accurate alignment with a single boring-bar equipped with tungsten-carbide tools. A shoulder between the two diameters bored in the housing prevents "through feeding," thus necessitating the use of specially designed equipment.

The machine developed for this work carries a fixture with a sub-slide which is parallel with the main table slide. This design increases the total stroke, thus facilitating loading of the work. The fixture also has a cross-slide which allows the work to be indexed transversely after the fixture has approached the tool, and just before the main table feed is engaged, so that the front boring tool will clear the shoulder between the two diameters to be bored.

The boring-bar, which has eccentrically mounted tools, is piloted in the fixture to the right of the pinion-shaft bore. Both slides are operated by hydraulic cylinders controlled through a valve at the front of the machine. 61



Ex-Cell-O Boring Machine Equipped to Bore Two Diameters in Differential Housing

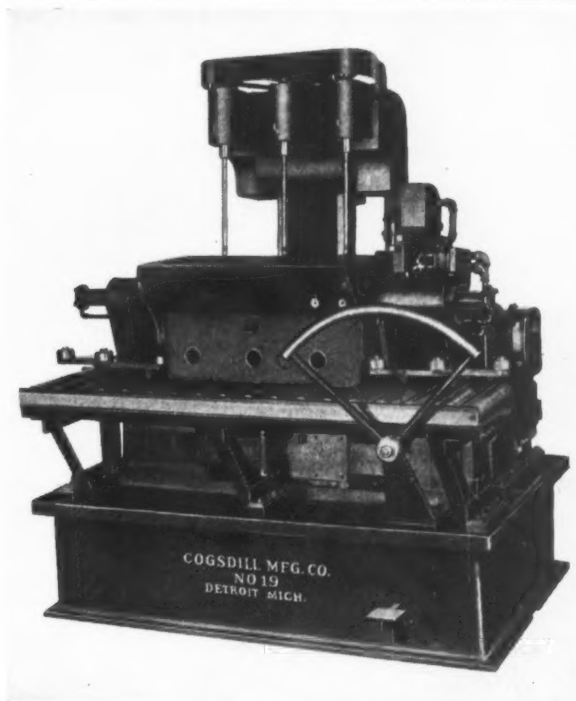
Portman Universal Cut-Off Machine

A cut-off machine of special interest to the aircraft and metal-working industries has been recently placed on the market by the Portman Machine Co., 2236A Bathgate Ave., New York City. An outstanding feature of this machine is that it permits taking bevel cuts and angular cuts with the work located in one position, straight across the face of the table. This feature saves considerable floor space.

The machine is provided with a fully automatic fence, which is self-compensating for all angles and requires no attention from the operator. The unique design of the universal head which carries the motor permits the abrasive cutting-off wheel to be fed down vertically at right angles to the work guide rail. The work-table and the wheel-head can also be swiveled 45 degrees either side of the right-angle position. As the table moves with the wheel-head in making angular adjustments, the slot in the table is always in line with the cut-off wheel, thus per-

To obtain additional information on equipment described on this page, see lower part of page 44.

Portman Universal Cut-off Machine



Cogsdill "Bearing-izing" Machine

mitting the wheel to pass through the work.

In addition to the swiveling movement about the central point of the table, the wheel-head can be tilted to an angle of 45 degrees to the left. Thus it is possible to set it for compound-angle cutting.

The motor head is self-contained, the abrasive disk or wheel being driven directly by the motor-spindle. The motor is a specially designed five-horsepower, square-frame type having a small spindle center distance, which permits the machine to handle work of relatively large size. This machine can be arranged for either wet or dry cutting. 62

Ex-Cell-O Grinder Built for Carboloy Company

We are informed by the Carboloy Company, Inc., that the low-cost carbide-tool grinder illustrated and described on page 884 of August MACHINERY is being manufactured by the Ex-Cell-O Corporation for the Carboloy Company, 2987 E. Jefferson Ave., Detroit, Mich. 63

Multiple-Spindle "Bearing-izing" Machine

The "Bearing-izing" process for finishing holes, developed by the Cogsdill Twist Drill Co., Inc., 6511 Epworth Blvd., Detroit, Mich., has been incorporated in a multiple-spindle machine recently designed and built by this company for finishing three valve-lifter bores in an internal combustion engine block at each cycle of the headstock. This machine is now in operation in a large automobile plant.

The main headstock is mounted on the top of a vertically traveling, hydraulically operated ram. On the headstock are mounted three precision spindle units and the driving motor, to which they are connected by two V-belts. Both belts pass around the motor pulley and the center spindle pulley. Each of these belts then passes around one of the outside spindle tools, thus driving all three spindles at the same speed.

The cylinder blocks come off the line conveyor directly on a conveyor section built into the machine, from which they are picked up by air-operated plungers which enter the camshaft bores. A control lever opens the Vickers hydraulic system, which starts the ram down at a rapid advance rate until a cam engages the feed control valve, which produces the desired feed while the tools pass through the bore.

The up stroke of the spindles can be stopped as soon as the tools are out of the bore, and the headstock and ram-carrier indexed to the next position. The full up stroke is not used until after the final pass of the Bearing-izer and the block is ready for removal from the machine.

The spindles, operating at a speed of 2500 revolutions per minute, drive the Bearing-izing tools so as to produce, by the cam-actuated peening rolls, approximately 200,000 blows per minute on the surface of the bore. These sharp blows drive down the "peaks" left by the previous operation, condense and work-harden the metal, thus leaving a burnished finish. A similar machine is used for finish-reaming the bores, leaving about 0.001 inch on the diameter for Bearing-izing. These machines have a capacity of 60 six-cylinder blocks an hour. 64

To obtain additional information on equipment described on this page, see lower part of page 44.

Gisholt Taper-Bolt Turning Attachment for Turret Lathes

A turret lathe attachment designed for the rapid and accurate turning of locomotive-frame taper bolts has been announced by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. The turning attachment is easily and quickly set up for machining taper bolts of different sizes, making it very useful for repair work, as well as for straight production. It will also turn straight or cylindrical work, thus permitting the taper bolts to be finished completely in one setting. Bolts 2 inches in diameter by 12 inches long can be machined with this attachment in 1 1/2 minutes.

The attachment can be fitted to either Gisholt 1L or 2L high-production turret lathes by merely changing the back plate for mounting on the turret face. A guide bar with a tapered guide cam which actuates the rollers and cutter is fastened to the headstock, as shown in the illustration. The tapered guide bar slides in the angle ways on the attachment and is so arranged that it can be swung out of the way when not in use. It is unnecessary to back the turning attachment off the guide bar, as the guide bar can be lifted out of the turning attachment at any position. This is an advantage in the case of short bolts.

In operation, the carriage feeds forward and the cam depresses the roller follower, which rotates a quill inside the attachment, moving the tool-slide and the roller slides outward at a uniform rate. The rollers follow immediately behind the tool, burnishing the tapered surface to a high finish.

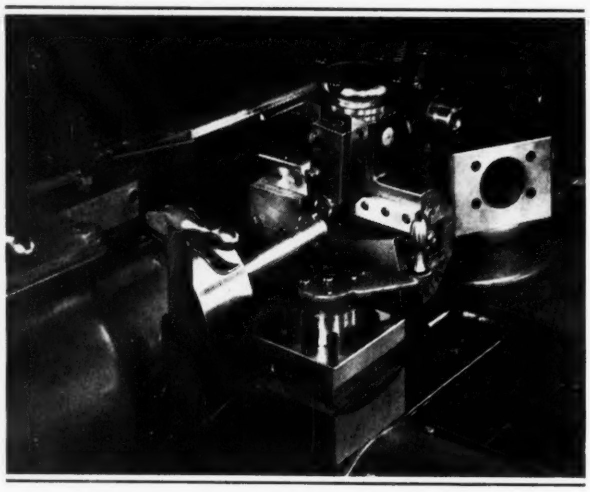
The attachment is equipped with adjustable tapered gibs to compensate for wear and to obtain an accurate adjustment on the tool-holder. The threads on the roller and tool-holder screws are provided with adjustment to eliminate backlash and to compensate for wear. The hardened and ground rollers are mounted on needle bearings, with provision for proper lubrication. The standard taper-bolt turning attachment will cut a taper having a maximum diameter of 2 1/2 inches and a minimum diameter of 5/8 inch, with a length of about 14 inches. The taper regularly provided is 1/16 inch per foot, which is standard for locomotive frame bolts. Different tapers can be furnished to order.

In practice, the large diameters of the taper-bolt holes are gaged on the assembly or the repair floor with simple plug gages. Taper bolts of the exact size required are then ordered from the turret lathe department. A set of twelve gages is required to cover the range of taper-bolt sizes from 1 inch to 2 1/2 inches. These gages have a taper of 1/8 inch per foot and have graduations representing a difference in diameter of 0.003 inch. 65

Lodge & Shipley Lathe Attachments for Obtaining Direct Diameter and Length Readings

Two lathe attachments designed to give direct-measurement readings of diameters and lengths have been brought out by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. These attachments can be installed on all standard lathes made by this company, from the 12- to the 36-inch size. They have been developed to eliminate cut-and-try methods and to facilitate the production of duplicate pieces.

The direct-reading diameter attachment, shown in Fig. 1, can be used with equal efficiency on turning, facing, boring, and other lathe operations. It is mounted on the cross-feed screw of the lathe, replacing the regular micrometer ball-stop. The combined readings registered on the micrometer dial and the counting arrangement indicate the exact diameter to which the work is machined.



Gisholt Turret Lathe Equipped with Taper-bolt Turning Attachment

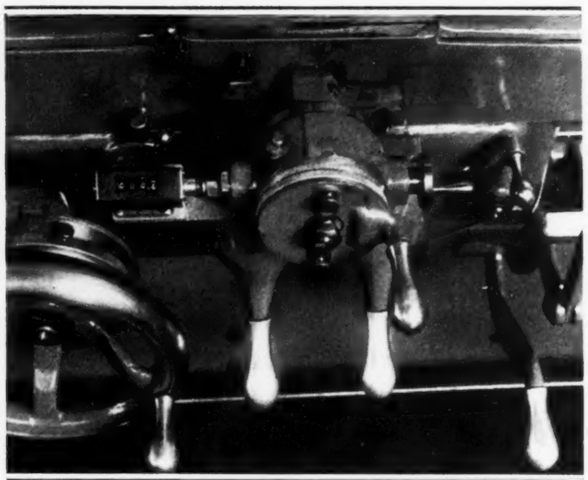


Fig. 1. Lodge & Shipley Direct-reading Diameter Attachment

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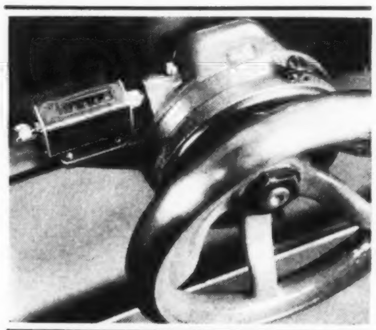


Fig. 2. Lodge & Shipley Length Reading Attachment

Each graduation on the dial represents 0.001 inch on the diameter of the work, and the right-hand column of the counter registers changes of 0.1 inch in the diameter of the work, covering a range of from 0.1 to 0.9 inch. The middle column of the counter registers changes in the diameter from 1 to 9 inches, and the left-hand column covers the range of from 10 to 90 inches. A decimal point separates the tenths column from the inch column.

In setting up the attachment, a diameter is turned on a work-piece held in the lathe, and, while the tool is still in the cutting position, the turned diameter is measured with a micrometer. The two thumb-screws on the front of the attachment are loosened to connect it to the cross-feed screw, and the micrometer dial and counter are set to register the micrometer measurement, using the small handwheel provided for that purpose. The thumb-screws are then tightened. When the attachment has once been set correctly, it will indicate the correct diameter measurements machined on this or any other work-piece held in the lathe, provided the tool settings are not changed and the micrometer counter settings are not disturbed. Proper allowance must, of course, be made for tool wear and for spring in the tool or work. Correction of these errors, if constant, can be made with the compound rest top slide.

The direct-reading length attachment, shown in Fig. 2, consists of a combined micrometer dial and counting arrangement. This attachment is used for measuring the length of cut on the work and for working to the dimensions shown on a drawing. When traveling toward the headstock, the micrometer dial and counter readings increase and when traveling toward the tailstock, they decrease.

The micrometer dial, having one hundred graduations, is geared to a sleeve on the apron handwheel shaft so that one complete turn of the dial represents exactly one inch of carriage travel. Each graduation represents 0.01 inch of carriage travel. The counting arrangement is similar to the one used for the diameter reading attachment but has a range of 0.1 to 999.99 inches of carriage travel. 66

Multiple-Spindle Vertical Boring and Drilling Machine

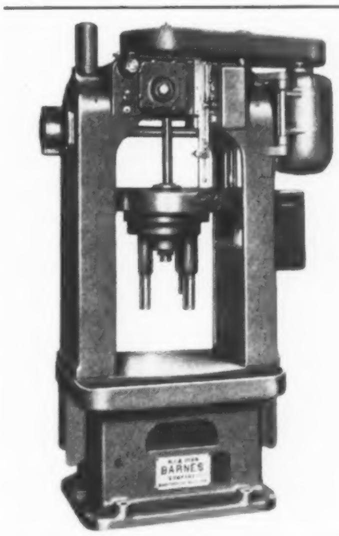
A hydraulic unit that provides an automatic cycle consisting of rapid approach, feed, adjustable dwell if desired, and rapid return of the multiple-spindle boring and drilling head to the starting position is an outstanding feature of the No. 900 vertical boring and driling machine recently brought out by the W. F. & John Barnes Co., Rockford, Ill. This machine has been developed especially for multiple-spindle work in connection with an indexing or stationary type fixture. It is particularly adapted for use where a conveyor carries the work through, or to and from, the machine. The base is of heavy ribbed construction and has a large trough for coolant and chips. There is a large sump in the base for coolant.

The driver head or flange on which the multiple drilling head is mounted is fastened to two round, hardened and ground bars. These bars are guided in head bushings mounted in the flange and form a rigid support and guide for the multiple head. Two hydraulic cylinders, one on each side of the machine, operate the multiple head. The cylinders and bar guides are protected by chip guards. An automatic equalizer and counterweight arrangement serves to counterbalance the multiple head.

The hydraulic feed unit consists of a constant-delivery rapid-traverse pump and a variable-delivery piston type feed pump coupled with a control valve. The automatic cycle is obtained through solenoid actuation of a valve, in connection with standard trip-dogs and a push-button starter. The small amount of piping used is enclosed within the structure. All rotating parts in the unit are self-lubricating. A second adjustable feed may be furnished as extra equipment.

Electric controls, including the starter, transformer, and push-button station, are mounted in one cabinet at the right-hand side of the machine. The machine is driven by a standard NEMA motor through a V-belt drive. The motor is mounted on an adjustable bracket and has a maximum rating of 7 1/2 horsepower at 1800 revolutions per minute.

The driver or spindle has a speed of 607 revolutions per minute. The maximum feeding pressure is 8200 pounds, and the rate of traverse is 188 inches per



Multiple-spindle Vertical Boring and Drilling Machine, Built by W. F. & John Barnes Co.

To obtain additional information on equipment described on this page, see lower part of page 44.

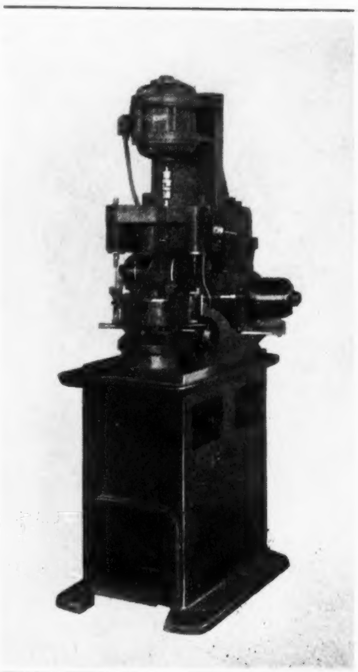
minute. The rate of feed is from 0 to 13 inches per minute, and the stroke of the head is 12 inches.

The height of the table from the floor is 26 inches, and the space between uprights for the fixture is 26 by 24 inches. The driver head has a diameter of 22 inches. The machine has a height of 90 inches, requires a floor space of 42 by 29 inches, and weighs approximately 4000 pounds. 67

Langelier Drilling and Tapping Machine with Indexing Dial

The vertical type drilling and tapping machine with hand-operated indexing dial here illustrated was designed and built by the Langelier Mfg. Co., Providence, R. I., for use in drilling and tapping textile lubricating saddles. The vertical head is equipped with three spindles, and the rear horizontal head has a two-spindle auxiliary unit.

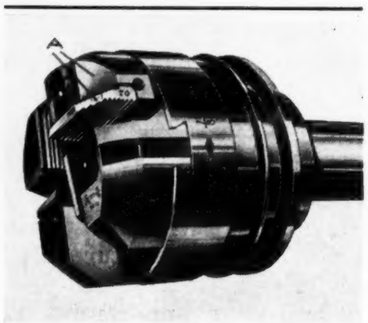
The parts are hand-loaded and the fixture lock-pin is operated from the foot-treadle. When the operating lever is tripped, the machine performs a complete cycle and returns to its starting position for indexing and loading a new part. The production rate averages 400 complete pieces per hour. 68



Langelier Drilling and Tapping Machine

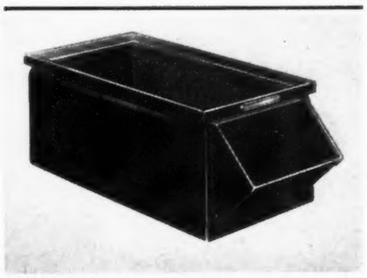
Landis Die-Heads for Special Threading Operations

The Landis Machine Co., Inc., Waynesboro, Pa., frequently finds it necessary to change the design of a regular die-head in order to meet some special production requirement. In the accompanying illustration is shown one of the many Landis die-heads that have been modified or changed to suit a special threading job. This particular die-head was made recently for one of the large automobile manufacturing concerns, for use in cutting the thread on the front-wheel upper control arm of the knee-action assembly. This control arm is a steel forging and has a very odd shape. A sharp bend immediately back of the threaded section made it exceedingly difficult to give a die-head of sufficient capacity for this threading job a chamfer large enough to clear the work.



Landis Die-head for Special Threading Job

The illustration shows a 7/8-inch Type L head with special chasers adapted for threading the control arm. The chasers and the chaser-holders are beveled at *A* to eliminate any interference or the possibility of their striking the control arm during the threading operation. 69



Stacking Box Made by the All-Steel-Equip Co., Inc.

All-Steel Improved Stacking Box

An improved construction that greatly increases the effective life of steel stacking bins and stack units designed for handling and storing all kinds of small parts has just been announced by the All-Steel-Equip Co., Inc., Aurora, Ill. A wide deep-formed stacking rim around the top of each unit allows the boxes to be built safely into stacks.

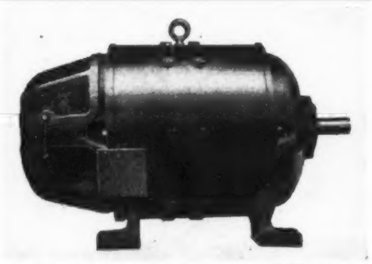
A new reinforcement of 12-gage drawn steel in angle form which is locked and welded in position under the hem at the top corners of the boxes resists any tendency of the corners to open or spread. The improved boxes and units will stack interchangeably with the earlier types.

The A-S-E stacking box shown has another new feature in the construction of the bin type front. The front rim angle and the two front corner reinforcements are formed from a single 10-gage piece. The rim is spot-welded to the sides and gas-welded to the bin opening, making the bin front an integral part of the unit. 70

Reversing Motor Drive for Planers

An improved design of reversing motor drive for planers using armature speeds of 150 to 600 revolutions per minute and 100 to 600 revolutions per minute, as against former standards of 250 to 1000 revolutions per minute and 200 to 600 revolutions per minute, has been brought out by

To obtain additional information on equipment described on this page, see lower part of page 44.



Reliance Reversing Motor Drive for Planer

the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio.

This drive is designed to start quickly at the end of each stroke. Improvements in the control equipment include a pendent control station with extra buttons which provide greater convenience in setting-up operations. The master reversing switch mounted on the planer bed has been made direct-acting to speed up its operation. The rheostat panel for controlling the cutting and return speeds is now made as a separate unit for convenient mounting. 71

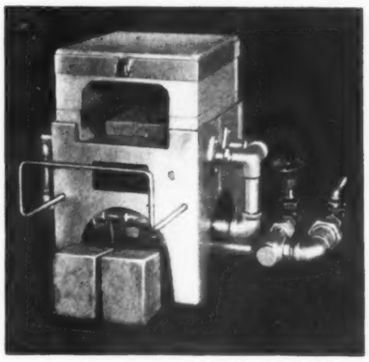
Improved Vernier Caliper and Height Gage

An improved Mauser precision tool which can be used as both a vernier caliper and a height gage has been introduced on the market by the George Scherr Co., 124 Lafayette St., New York City. The outstanding improvement in this gage is a combination quick-action cam lock and fine adjusting screw, which permits easy setting to close limits of accuracy. The cam lock is released by pressing the fine adjusting screw until the approximate measurement is obtained. Then, in order to secure fine measurements to 0.001 inch, the adjusting screw is turned while the cam lock remains closed.

This precision instrument, known as the Model 407-R, is 9 inches long and has a measuring capacity of 6 1/4 inches. It has an accurately lapped steel base and scriber which are attached to the caliper jaws, thus making the tool quickly available as a height gage. It also has two knife-edges which are convenient for lay-out work, for measuring distances between holes, and for measuring root diameters of gears, threads, etc. 72

Convertible Bench Forge

A bench type forge that is especially well adapted for use in small shops or laboratories having a limited amount of heat-treating or forging work has been brought out by the American Gas Furnace Co., Elizabeth, N. J. When used for forging,



Bench Forge Arranged as an Oven Heater

the furnace is so arranged that it has entrances at both ends, which are 6 inches wide by 2 inches high. The depth inside the heating chamber is 6 inches. A banded cover brick can be removed for heating long rods at any mid-point. An adjustable rack serves to support long work.

For heat-treating, the forge is quickly converted to a heating oven by using a special brick top, hearth slab and supports, and end bricks which form a semi-muffle type heating chamber 4 1/2 inches wide, 6 inches long, and 2 3/4 inches high. The temperature necessary for treating high-speed steel can be obtained quickly. Welding heats can be obtained in twenty-five to thirty minutes. Where a low-pressure air supply is not available, a separate turbo-blower which operates from the lighting circuit is supplied. 73

Multi-Miller of Increased Capacity

The U. S. Tool Company, Inc., Ampere, East Orange, N. J., has recently brought out an MM-5 Multi-Miller to meet the demand for a machine with the versatility of previous Multi-Millers, such as the one described in January MACHINERY, page 343, but of greater capacity.

Rotary milling, contour milling, climb milling, continuous milling, and other kinds of machine work done on previous machines can be handled on this new machine, in which the table feed has been increased from 4 to 6 inches. The machine has also been designed for a one-horsepower spindle-driving motor in place of the one-half horsepower motor used with previous machines.

Parts for small arms, hardware, pliers, and other fairly heavy pieces requiring similar machining operations are typical of the class of work that can be handled on this Multi-Miller. This machine is adapted for climb milling, as well as conventional milling, and can be equipped with power-driven feed-

Multi-Miller Brought out by the U. S. Tool Company

To obtain additional information on equipment described on this page, see lower part of page 44.

rolls for continuous form milling of strip or coil stock.

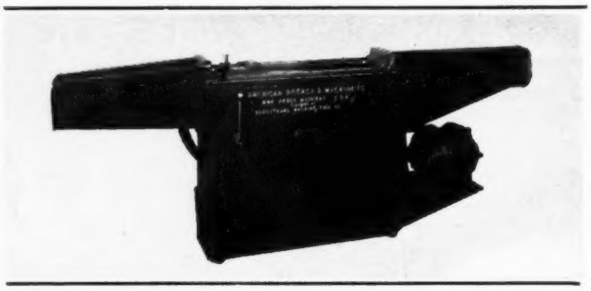
Vertical milling, high-speed grinding, spur-gear cutting, and hand-milling operations can also be performed on this machine. A single operator can tend as many as six machines, depending upon the work milled. The table is rack-driven by a cam-operated sector. Eight table feeds are available for each standard feeding cam. The table cycles can be arranged from 5 seconds to 2 minutes, with a range of cutting speeds from about 1/6 inch per minute to 30 inches per minute. 74

Stacking Box of Welded Construction

A stacking box with a one-piece stacking rim has been developed by the Stackbin Corporation, 44 Troy St., Providence, R. I., which has the advantages of unusual strength, rigidity, and light weight, with freedom from torn corners.

The stacking rim rests upon and is welded to the sides of the box. The rim is of 14-gage steel, double thickness, formed in one piece, and welded to make a solid rim which resists corner bending, even under heavy loads and rough handling. 75

Stackbin Light-weight Stacking Box of Welded Construction



Horizontal Hydraulic Broaching Machine Made by American Broach & Machine Co.

American Horizontal Hydraulic Broaching Machine

A recently redesigned model of the Type H horizontal hydraulic broaching machine described in August, 1937, MACHINERY, page 817, has been brought out by the American Broach & Machine Co., Ann Arbor, Mich. This new machine, designated the Type H-2-30, has a fast return stroke and is equipped with a Sundstrand pump unit. It is a pull type machine, designed for light internal broaching operations, such as broaching keyways and splines, or round, square, hexagon, and various-shaped holes.

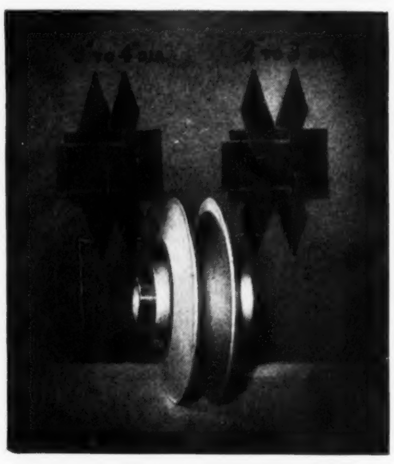
The machine can be easily and quickly adapted for different operations by changing work bushings, broach-pullers, and broaches. Surface broaching operations can be performed rapidly by using suitable fixtures and tools. The machine bed is of heavy ribbed box-section construction and contains the hydraulic reservoir in which the pumping unit is submerged. The coolant tank and chip receptacle are located in a separate compartment in the base.

The long draw-head has a lubricating oil reservoir in its body. The oil is fed to the hardened and ground steel guides which are built into the draw-head. Positive lubrication to the guide bars and slide ways provides long life and helps to maintain accurate alignment. Dual cylinders with ram connections to the draw-head give a fast operating cycle with a steady balanced pull on the cutting stroke and a fast movement on the return stroke.

The normal capacity rating of this machine is two tons, and its maximum rating four tons. The total pulling area of the two cylinders is 9.4 square inches. The stroke is 30 inches, and the maximum over-all broach length, 33 inches. The draw-head cutting speed is 28 feet per minute, and the return speed 48 feet per minute. The diameter of the hole in the faceplate is 5 inches, and the distance between the guide ways 8 1/2 inches. The vertical adjustment on the draw-head above center is 1 1/8 inches, and below center, 1 1/2 inches. The weight of the machine is 2500 pounds. 76

Allis-Chalmers Single-Groove Adjustable Sheave

The Texrope Division of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has developed an adjustable Texsteel sheave for double-duty service which is particularly adapted for use in the heating and ventilating field. This sheave has a range of pitch diameters varying from 2 to 3 inches and from 3 to 4 inches, either range being obtained by



Allis-Chalmers Sheave with Adjustable Pitch Diameter

To obtain additional information on equipment described on this page, see lower part of page 44.

merely removing the adjustable plate, reversing it, and replacing it on the hub.

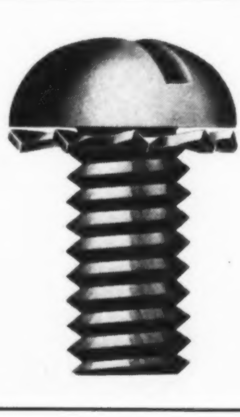
When the outer plate is in the position shown at the left in the illustration, the Texrope belt rides high in the groove, giving a pitch diameter ranging from 3 to 4 inches. When the outer plate is reversed, as shown in the view at the right, the Texrope belt rides low in the groove giving a pitch diameter ranging from 2 to 3 inches. 77

Shakeproof Fastening Unit

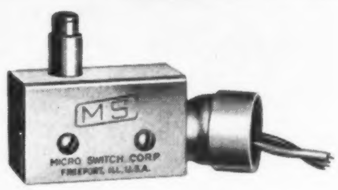
A preassembled shakeproof lock-washer and standard machine screw designated SEMS is the latest addition to the line of metal fastening products made by the Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, Ill.

This new patented unit has been developed in order to save time and to reduce labor in assembling operations, thus speeding up production and eliminating waste through lost lock-washers. It also insures having each screw equipped with the correct size of lock-washer for its particular type of head.

As the lock-washer cannot drop off, no screw can be applied without having a lock-washer under its head. Tests in both large and small production plants indicate cost savings, as well as faster production. 78



Shakeproof Lock-washer and Screw Assembly



Series Q Metal-clad Over-travel "Micro" Switch

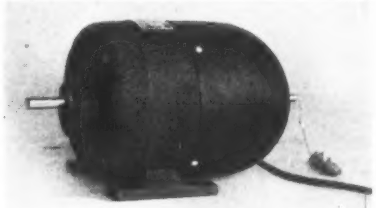
Over-Travel Metal-Clad "Micro" Switch

A new metal-clad "Micro" switch with an over-travel of 1/4 inch, known as Series Q, has been placed on the market by the Micro Switch Corporation, 3 E. Spring St., Freeport, Ill. This switch has an actuating plunger which can be moved 1/4 inch beyond the operating point without straining the snap-action mechanism, changing its characteristics, or affecting its life. A pre-travel of 0.015 inch with an operating pressure of 7 to 8 1/2 ounces and a movement differential of 0.0002 to 0.0003 inch is required for operating.

Contacts can be arranged for normally closed, normally open, or double-throw circuits. This switch is listed by Underwriters Laboratories for capacities of 10 amperes, 125 volts alternating current; 2 amperes, 600 volts alternating current; and 1/2 horsepower motors operating on 115 to 460 volts alternating current. The over-all dimensions are 2 1/8 inches high, 1 inch wide, and 3 1/4 inches long. 79

Permanent Split-Phase Ventilating Fan Motor

A permanent split-phase motor of shaded-pole design having a shaded-pole winding for producing a split field which permits sub-synchronous operation has been brought out by the Reynolds Electric Co., 2650 W. Congress St., Chicago, Ill. This motor is intended primarily for use in operating fans and blowers. A starting winding is employed as in the split-phase type,



Reynolds Split-phase Ventilating Fan Motor

except that this winding is permanently connected to the main winding.

This type of motor has a rather low starting torque, relatively efficient full-load characteristics, and rather high breakdown torque. The temperature rise is approximately 55 degrees. This motor is built in sizes from 1/20 to 1/6 H.P. 80

Stop-Off Lacquers for Use in Chromium Plating

The Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich., has recently developed two new types of stop-off lacquers for insulating plating racks used in decorative plating, and for masking parts to be hard chromium-plated. These lacquers are known as "Miccro Supreme Stop-off Lacquers." They are applied directly on the metal surface, with no treatment other than a thorough cleaning of the surface.

The lacquers used for insulating plating racks have proved to be practically unaffected through the regular cycle of decorative plating. Tests conducted over prolonged periods with alkaline cleaner at 212 degrees F. showed the coating to be still effective after 500 hours of continuous immersion. These lacquers have also proved effective when subjected to concentrated or diluted hydrochloric acid or sulphuric acid dips, cyanide or acid copper baths, standard or bright nickel baths, and chromic acid baths. They are impervious to nitric or hydrofluoric acids, as well.

The lacquers used with hard chromium-plating processes, while exceptionally adhesive, can be

To obtain additional information on equipment described on this page, see lower part of page 44.

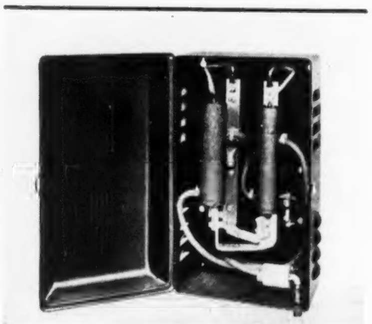
removed easily after plating, permitting thorough cleaning of the parts that have been coated. The lacquers dry rapidly in air.

Among other applications for these lacquers are their use for tank coatings, insulating bus-bars to prevent corrosion, protection of ventilating systems, and for covering water lines to prevent sweating or rusting. 81

Westinghouse Electronic Welding Contactor

A new "Weld-o-trol" electronic power switch for controlling the primary of welding transformers, which is suitable for use with existing timing devices, has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This switch is intended for use in welding mild steel and other readily welded metals. With either sealed-off or continuously pumped ignitron tubes, the Weld-o-trol offers an instantaneous power switch for producing uniform welds. The variable ratings are roughly equivalent to 300- and 600-ampere conventional welding contactors.

Weld-o-trols equipped with sealed-off tubes consist of a sheet-metal cabinet in which are mounted a bus-bar assembly, electrical connections, and a flow switch. The only electrical connections required are one power cable entering the unit and one leaving the unit (the Weld-o-trol acting as a single-pole single-throw switch), and two control leads from the timer. No additional voltage control is required.

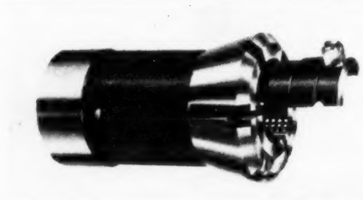


"Weld-o-trol" Electronic Welding Contactor

The complete assembly with sealed-off tubes is available either open or enclosed. The open type is recommended for applications that require mounting inside a welding machine or with other auxiliary control equipment. 82

"Martin Master" Collet

The Modern Collet & Machine Co., Ecorse, Mich., has recently introduced a collet known as the "Martin Master," which can be converted quickly from one size to another without removing the collet body from the machine spindle, by simply changing the three clamping pads. A few turns of the wedge screws in the locking wedges permits quick removal of the pads, one of which is shown removed from the collet body in the accompanying illustration.

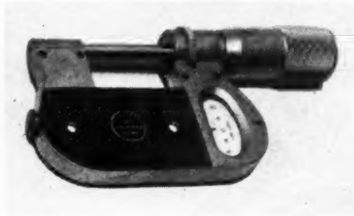


"Martin Master" Collet Made by Modern Collet & Machine Co.

The pads and the body of the collet are made of different kinds of steel and heat-treated separately. The pads are heat-treated to a hardness greatly exceeding that of the body and are made of specially selected wear-resisting steel. The body is made to give the utmost in both toughness and resiliency. 83

"Compar" Indicating Micrometer and Comparator

The George Scherr Co., 124 Lafayette St., New York City, has just introduced on the market an indicating micrometer and comparator having an indicator mechanism of the knife-edge lever type which is designed to maintain a high degree of accuracy under constant usage. A visual means of determining the measuring pressure eliminates the uncertainty of measuring "feel." There is an anvil-relieving button which moves the lower anvil back to permit inserting and removing the work, which can be measured to 0.0001 inch. When the work is inserted and the button released, the anvil is pressed against the work by a light-pressure return spring. Thus the reading is always the same, regardless of who does the measuring.



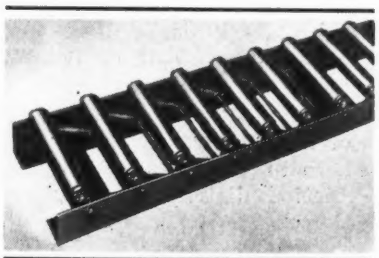
"Compar" Micrometer and Comparator

The spindle is hardened throughout and has a thread ground from the solid material. The anvil faces are all cemented tungsten carbide and are ground, lapped, and polished plane and parallel to optical flat gages which are accurate to 0.000012 inch. The entire instrument is constructed to withstand the constant wear to which a measuring device of this kind is subjected under quantity-production conditions. 84

Shock-Absorbing Spring-Suspended Roller Conveyor

The Standard Conveyor Co., North St. Paul, Minn., has developed an impact-absorbing roller conveyor designed to remove the loading shocks from the roller bearings and shafts. Each roller assembly is mounted in a set of steel arms pivoted on a shaft which extends through the arms and frame. There are two coil springs in each roller assembly,

To obtain additional information on equipment described on this page, see lower part of page 44.



Spring-suspended Roller Conveyor Made by Standard Conveyor Co.

one being attached to each arm. When the load carried on each roller assembly exceeds the rated capacity for which the assembly is set, the excess load is transmitted to the coil springs. As soon as this excess load is absorbed from the first shock, the coil springs return the rollers to their normal carrying level. If one assembly is called on to carry more than its share, the irregularities of the load being conveyed cause the over-burdened roller to be depressed sufficiently to distribute the load over the other rollers. 85

Oakite Cleaning and Deodorizing Material

A material has been developed by the Research Laboratories of Oakite Products, Inc., 26 Thames St., New York City, that combines the properties of cleaning and deodorizing. This material is now available for use by industrial and other concerns having an odor control problem, either in connection with processing operations or in general plant maintenance. The new material is odorless in itself. It is effective both in dissipating previously formed odors and in preventing odors due to a continuous process. 86

Sundstrand "Oil Power" Variable-Speed Transmission

The Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., has brought out a new line of "Oil Power" variable-speed transmissions. These units have an extremely wide speed range, and develop high torque with smooth operation at slow as well as high speeds. High mechanical efficiency is also provided throughout the entire speed range, and operating temperatures are low for either continuous or intermittent duty. Instant reversal at high speeds on continuous-duty operation is an important factor which greatly increases the range of applications of these hydraulic transmissions in both the industrial and machine tool fields.

Sundstrand "Oil Power" Variable-speed Transmission

The transmissions are housed in a small compact case and consist of a variable-displacement multiple-piston type pump, a fluid motor of the multiple piston type which may be of either variable or constant displacement, and a simple control mechanism. The control can be operated either manually or automatically. The five-horsepower unit illustrated provides a speed range of from 3 to 2400 revolutions per minute. Two- and ten-horsepower units are also available. 87

Williams Torque "Measurrench" and "Supersocket" Wrench Set

A unique yet simple tool for measuring right-hand turning torque has been developed by J. H. Williams & Co., 61 Spring St., New York City. This tool, known as the torque "Measurrench," is shown in the upper view of the accompanying illustration. It is equipped with various sizes of detachable socket bits for hollow set-screws having 1/8- to 5/16-inch hex-drive openings.

The design of the tool is such as to prevent the hollow set-screws or socket bits from being damaged by over-tightening. The tool is calibrated with numbers corresponding to the numbers of the various size bits that it accommodates, and when the index line on the bar touches the line indicating the number of the bit in use, the proper load has been applied to the hollow screw. Since the head can be moved along the bar, this tool can be instantly transformed into a conventional sliding T-handle for use without the torque-measuring feature.

The "Supersocket" wrench set for hollow screws, shown in the lower view of the illustration, is another new product of the company. This wrench set is composed of bits, parts, and handles. The AL-101 set contains nineteen pieces, including ten bits for handling 1 1/4- to 1 3/8-inch hollow hexagonal socket set-screws and hollow cap-screws in sizes from No. 8 to 1 inch. These bits have a knurled end which permits fast spinning of the screws until they become tight enough to require turning with the handle or driver. There are nine handles and parts, including two reversible "Superratchet" handles and a torque "Measurrench." 88

Williams "Measurrench" and "Supersocket" Wrench Set

To obtain additional information on equipment described on this page, see lower part of page 44.

An Engineer's Manual on Tools

What is known as "Engineering Manual No. 400 on Standard and Special High-Production Tools" has just been published by Scully Jones & Co., 1901 S. Rockwell St., Chicago, Ill. This is a handsomely bound volume of 320 pages, 8 1/2 by 11 inches, illustrating and describing a very extensive line of tools for the metal-working industries.

An interesting feature of the manual, which may be obtained free of charge from the company, by men holding responsible positions in the mechanical industries, is that it contains a picture index consisting of eight pages of halftones. Often a tool is known by one name in one plant and by another somewhere else. Some people call a collet a sleeve, and others call it a chuck. By referring to the picture index, the tool can be located quickly and the accepted name ascertained.

In the catalogue section, a halftone illustration, a line engraving, and a table give complete information on each type of tool. This catalogue has well been termed an "Engineer's Manual," since it is actually a hand-book on production tools.

* * *

The great difficulty in this world seems to be that it is much easier to be vociferously *against* things than it is to stand courageously *for* things.

Is an Annual Wage for Labor Feasible?

As one in a series of booklets on industrial economic subjects, Allen W. Rucker, in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., has published a booklet entitled, "How Feasible is an Annual Wage for Labor?" The booklet, which can be obtained by application to the company, points out that while the present average annual wage for those employed is about $1100, this level would be materially reduced if an annual wage had to be paid to all people available for manufacturing work, many of whom are seasonally so employed. The authors conclude that it is unlikely that any union or political leadership would have the courage to propose an annual wage low enough to permit the employment, on an annual basis, of the total industrial labor available.

* * *

Whatever else may have helped to develop American industry, the American spirit of business enterprise has been the mainspring of our progress, aided at every point by the use of good advertising in distributing the products of industry. The high standard of life in America is an achievement of business, and it is not the nature of business to be satisfied with past performances.—*Advertising Federation of America*

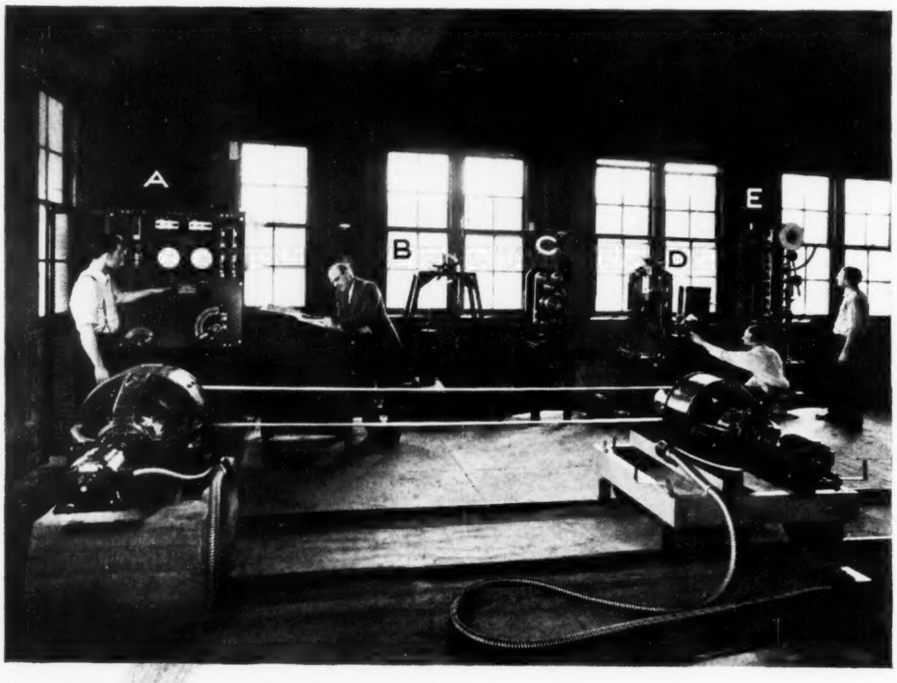
International Management Congress

The program for the seventh International Management Congress to be held in Washington, D. C., September 19 to 23, covers many phases of management problems as applied both to general administration, production, distribution, and labor relations. Among the addresses to be given is one on "The Balancing of Incentive and Security," by Ralph E. Flanders, president, Jones & Lamson Machine Co., Springfield, Vt. The program can be obtained by application to Merrill B. Sands, 347 Madison Ave., New York City.

* * *

British Machinery Exports

The exports from Great Britain of all classes of machinery in 1937 amounted to $249,000,000, as compared with $197,000,000 in 1935, and $206,000,000 in 1936. British imports of all classes of machinery in 1937 amounted to $121,000,000, as compared with $66,000,000 in 1935, and $90,000,000 in 1936. The United States supplied the largest proportion of the imports both of machine tools and of machinery in general in all three years, Germany being the next largest supplier. The total imports of machine tools from the United States amounted to $17,238,000 in 1937; the machine tool imports from Germany amounted to $8,079,000.



Belt Testing Laboratory of Alexander Bros. at Williamsport, Pa. In the Illustration, A Indicates a Test of the Horsepower Transmitted by a Flat Belt. At B is Shown the First Step in Determining the Coefficient of Friction. The Pulley is Fixed, and the Strip of Leather, Weighted at One End, is Made to Slip over the Pulley. At C a Test is Conducted to Measure the Efficiency of Cemented Laps. At D is a Machine Used to Test the Elongation and Tensile Strength of Leather Belting. At E is Shown a Machine for Determining the Pull Required to Separate the Plies of a Double Belt.

NEWS OF THE INDUSTRY

Colorado

J. L. Singleton, who has been in charge of the Allis-Chalmers Mfg. Co.'s district office at Denver, Colo., for some time, has now been appointed manager of that office.

Connecticut

Peck, Stow & Wilcox Co., Southington, Conn., announces the election of the following officers: Mark J. Lacey, president and general manager; Major Frank L. Wilcox, vice-president; Edward G. Hackbarth, vice-president and assistant treasurer; and Samuel C. Wilcox, secretary and treasurer. Floyd J. Neal has been appointed sales manager of the tools and hardware division, and William O. Seifert sales manager of the machinery division.

Norma-Hoffmann Bearings Corporation, Stamford, Conn., due to the increasing demand for its ball, roller, and thrust bearings, has just completed an extension to its present manufacturing plant and has placed substantial orders for new machine tool equipment.

Illinois

G. S. Rogers & Co., 228 N. La Salle St., Chicago, Ill., has been organized to resume and extend the activities of G. S. Rogers & Associates. New liquid and solid carburizers, heat-treating and drawing salts, quenching oils, core oils, cutting oils, drawing compounds, and metal cleaners are being made and marketed by the corporation. G. S. Rogers, president, has for twenty-six years been closely identified with these fields as chemist, metallurgist, consulting engineer, and distributor.

Edward S. Coe, Jr., has been transferred from the Buffalo plant of Farrel-Birmingham Co., Inc., Ansonia, Conn., to its branch sales office at 1059 First National Bank Bldg., Chicago, Ill. Mr. Coe is a graduate of Worcester Polytechnic Institute, class of 1931. He has been with the Farrel-Birmingham Co. for several years.

George C. Smith has been promoted to the position of Chicago district sales representative of the Small Tool Division of the Taft-Peirce Mfg. Co., Woonsocket, R. I. The Chicago office and warehouse of the company are located at 564 W. Randolph St.

Mid-West Production Engineering, Inc., 1401 E. Milwaukee, Detroit, Mich., has appointed Neff Kohlbusch & Bissell of Chicago exclusive agents in the Chicago and Milwaukee territory for the sale of Hydro-Pierce machines.

K. & J. Tool Engineering Co. has been organized for the purpose of designing dies, jigs, fixtures, gages, and special machinery, and has opened offices at 715 W. Lake St., Chicago, Ill.

Indiana

American Foundry Equipment Co., Mishawaka, Ind., has prepared a new industrial film in color entitled "Wheelabrating—The Modern Airless Method of Abrasive Blasting." The film shows equipment used for cleaning work in the foundry, forge shop, heat-treating department, and metal-working plants in general. It shows equipment in operation in the Buick, Chevrolet, Bendix, Allis-Chalmers, and other well-known plants. Anyone interested in showing this motion picture at their plant or before a trade association can make arrangements for the loan of the film by applying to the American Foundry Equipment Co.

William W. Bond has been appointed western sales manager of the Positive Drive Division of the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., with headquarters at the Dodge plant in Indianapolis, Ind. Mr. Bond has been with the company since 1911. Ralph S. Dyson, for many years manager of stock silent and roller chain drives through distributors, will also be the head of roller chain sales to duplicate machinery manufacturers. Mr. Dyson entered the employ of the company in 1899.

Michigan

Carboloy Company, Inc., Detroit, Mich., started the construction of a new factory in Detroit on August 10, to be located on Eight Mile Road, one-half mile east of Van Dyke Ave. The new plant, which will cost about $700,000, will bring under one roof the entire manufacturing facilities of the plants now located at Cleveland, Ohio; Stamford, Conn.; and Detroit, Mich. The new plant will have a total area of approximately 121,000 square feet. It will be ready for occupancy about January 1, 1939, and will employ some 500 people when operating at capacity.

C. M. Peter, General Sales Manager of Fellows Gear Shaper Co.

W. F. Slomer, who for many years has been general sales manager of the Fellows Gear Shaper Co., Springfield, Vt., and who has been ill for the last eighteen months, has found it necessary to give up his active connection with the company. He will be succeeded by C. M. Peter, formerly export sales manager and for the last fifteen years managing director of Black & Decker Ltd. Mr. Peter will make his headquarters at 616 Fisher Bldg., Detroit, Mich.

Ludwig Emde has been appointed sales manager in the Detroit district of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Emde has been with the Worthington organization since his graduation from the University of Michigan in 1930. He succeeds William J. Daly, who was recently transferred to the corporation's Philadelphia office as manager.

L. Clifford Goad has been appointed general manager of the A C Spark Plug Division of the General Motors Corporation, Flint, Mich. Mr. Goad succeeds Fred S. Kimmerling, who has been on leave of absence since last September because of ill health.

New York

Oakite Products, Inc., New York City, manufacturers of industrial cleaning materials, announce a rearrangement of the eastern field sales and service organization. Owing to the serious illness of J. A. Maguire, Detroit division manager, H. C. Duggan, who has been with the company fourteen years, will take charge of sales and service in that division, with headquarters in the General Motors Bldg., Detroit. The company's New York and New England divisions have been consolidated into one unit, to be known as the Northeastern Divi-

sion. D. X. CLARIN, New York division manager, who has been associated with the company for the last nineteen years, will be the head of the consolidated division, with headquarters in the company's general offices, 22 Thames St., New York City.

LINDBERG ENGINEERING CO., 221 N. Laflin St., Chicago, Ill., has opened an office at 220 Delaware Ave., Buffalo, N. Y., with HARRY O. MUNN, formerly chief service engineer of the company, in charge. Mr. Munn will cover the western New York territory.

Ohio

TIMKEN ROLLER BEARING CO., Steel and Tube Division, Canton, Ohio, announces the appointment of the following distributors for "Timken Graphitic" steels for dies and tools: A. MILNE & CO., 745 Washington St., New York City, 109 Broad St., Boston, Mass., and 21 N. May St., Chicago, Ill.; HAMILTON STEEL CO., E. 131st and Taft Ave., Cleveland, Ohio; CRAINE-SCHRAGE STEEL CO., Detroit, Mich.; QUALITY STEELS, INC., Dayton, Ohio; and COULTER-SIBBETT STEEL CO., 240 Eighth St., Oakland, Calif.

C. W. BRIGGS, physical metallurgist at the Naval Research Laboratory, Washington, D. C., will join the Steel Founders' Society of America, Cleveland, Ohio, about October 1, in the capacity of technical engineer. Mr. Briggs is a graduate of Stanford University. Since his graduation, he has devoted most of his time to research work for the U. S. Navy, being at present the directing head of the steel casting research department.

HOMER KENDALL, formerly associated with the Alliance Machine Co., Alliance, Ohio, has been appointed to handle special engineering problems in sales work with the Salem Engineering Co., Salem, Ohio. Mr. Kendall's experience is especially along the line of designing and building handling equipment for furnaces in industrial and forge plants, including all types of cranes.

Pennsylvania

J. W. HERMAN has been elected treasurer of the Lukens Steel Co., Coatesville, Pa., succeeding the late George Thomas, 3rd. Mr. Herman has been connected with the company since January, 1916, except for the year 1918-1919 during which he served in the army.

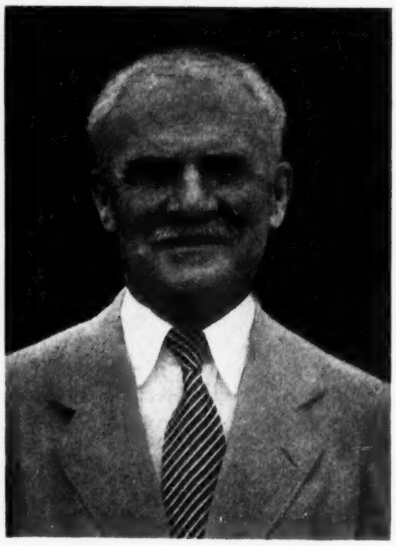
ROBERT E. BROWN, 311 Ross St., Pittsburgh, Pa., has been appointed representative in the Pittsburgh territory for the sale of the lifting and separation magnets made by the Ohio Electric Mfg. Co., Cleveland, Ohio.

H. L. HUXSTER, 1110 Darby Road, Upper Darby, Pa., has been appointed district sales representative for the Trico Fuse Mfg. Co., Milwaukee, Wis., in southeastern Pennsylvania and southern New Jersey.

OBITUARIES

George R. Rayner

George R. Rayner, executive vice-president of The Carborundum Company, Niagara Falls, N. Y., and one of the most prominent industrial leaders of Niagara Falls, died at his home in Lewiston Heights, August 15 after an extended illness dating back to July, 1937. In his death, the personnel of The Carborundum Company mourns the passing of one of the most highly respected members of its executive staff.



George R. Rayner

Mr. Rayner was born in Northampton, Mass., August 6, 1871, and had been with The Carborundum Company since August, 1898, when he went to Niagara Falls as secretary and general sales manager, following a period of sales activity in the Chicago territory. Shortly after the World War in 1919, he was elected vice-president of the company, which position he held until his death. During his forty years association with the company he was active in developing the abrasive industry.

HENRY LAIDLAW, of Detroit, Mich., widely known in the pumping machinery field, died in Kingsville, Ont., Canada, on June 25 of heart trouble. Mr. Laidlaw was born in Innerleithen, Scotland, on June 6, 1860, and came to the United States in 1880, where he first worked several years as a machinist for the John H. McGowan Co. In 1887, he joined his brother, Walter Laidlaw, who was one of the founders of the Laidlaw-Dunn-Gordon Air Compressor Co., and became the first salesman for the company. When the International Steam Pump Co. was formed in 1898, of which the Laidlaw-Dunn-Gordon Co. was a member, he became sales manager of the company's Detroit district office, and also held the same position with its successor, the Worthington Pump & Machinery Corporation, until 1927 when he was made special representative for the same office. His genial personality won him a wide circle of friends.

HERBERT MYGATT WILCOX, manager of the New Products Division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., died suddenly of heart disease on July 28 while in New York City on business. Mr. Wilcox was born in Pittsburgh, Pa., on November 6, 1882. He graduated from the Massachusetts Institute of Technology in 1905 with the degree of B.S. in chemical engineering. In 1914, he joined the Winchester Repeating Arms Co. as industrial engineer, and in 1925, became commercial manager for the Western Electric Co. In 1937, he became associated with the Westinghouse Electric & Mfg. Co.

* * *

Court Overrules Labor Board on Rehiring Sit-Down Strikers

According to information published in the daily press, the Circuit Court of Appeals has overruled the National Labor Relations Board in the case of the Fansteel Metallurgical Corporation, North Chicago, Ill. The board had ruled that the corporation must reinstate ninety-two persons discharged for conducting a sit-down strike in the plant in February, 1937. According to the Court, "an employer is warranted in discharging his employes ... when they take and retain exclusive possession of his property against his will." Comments are unnecessary. It seems unbelievable that a court should even have to pass on this matter.

* * *

A Successful Suggestion System

The General Electric Co.'s employes received nearly $85,000 in 1937 for new ideas submitted through the company's suggestion system. During the year, almost 37,000 suggestions were made by workers, and more than 12,000 were adopted. In the last eleven years nearly $600,000 has been paid out to employes for new ideas adopted.